

## The Analog Solar Tracking System

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### PURPOSES

Engineers Without Borders Iran (founded by Soheil Salimi - Water, Air, Pollution and Energy MSs graduated student - Ecole Polytechnic) has initiated promoting solar cooking in Iran (centered in Shiraz) since 2013 by a young motivated team (in engineering & sciences). The activities started by successfully testing simple solar cookers (e.g. Suntastic Panel Cooker) and presenting them through a seminar in "Research Week" (Dec. 14 - 20, 2013) - Fasa University, and have been continued by several workshops, and public outreach events in different cities and places in Iran, including universities, schools and rural regions, Fig. 1-5 [EWBIran-SCI].

The motivated team of EWB-Iran has targeted these goals as the upcoming projects:

- Building sun-tracker system in order to increase the efficiency of solar cookers (the first phase of methodology has been studied as the team member Ms. Rahimi's BSc. Project - Mechanical Engineer)
- Designing new types of solar cookers for job creation in poor regions
- Testing solar cookers for water purification/wastewater treatment, using sea-water next to the Persian Gulf (south of Iran) for local food growing
- Pursuing public outreach, and organizing workshops & seminars in universities, schools and public places

### RESULT

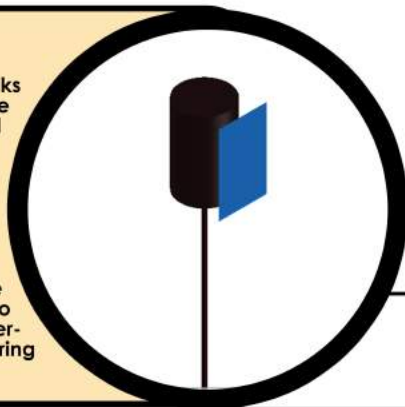
The new solar tracking system is designed to track sun rays without the need to change the direction of panel manually. The analog solar system is capable of finding the best panel direction in order to get the maximum energy from the sun. Using its two double acting hydraulic cylinders, the system then changes the direction of solar cooking panel automatically. Food constantly captures the maximum energy which allows cooking at the least possible time.

This system is designed to be cheap and easily affordable. Pneumatic Systems used in this model are operated along with the working fluid of R134a. The working fluid absorbs and transmits energy to move the cylinder arms for changing the direction of the panel. Panel rotating is available around 2 axis which can perfectly track the sun.

### Pneumatic tank

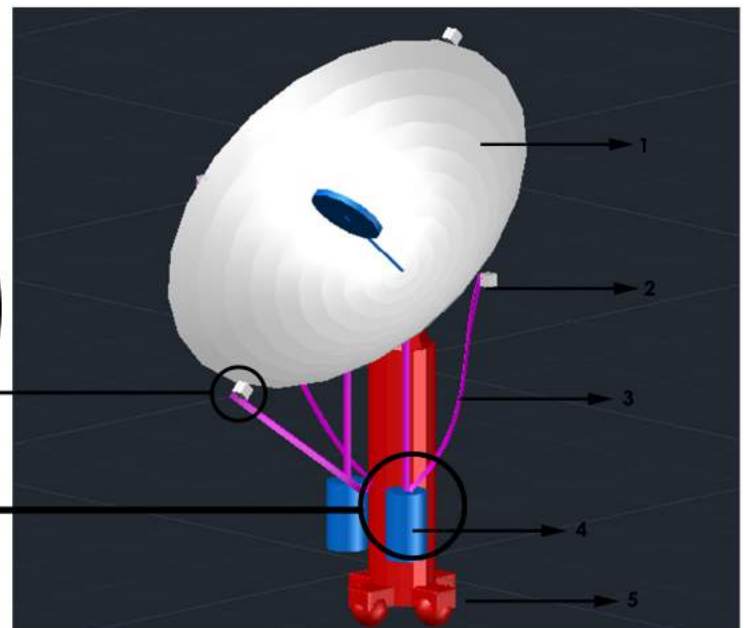
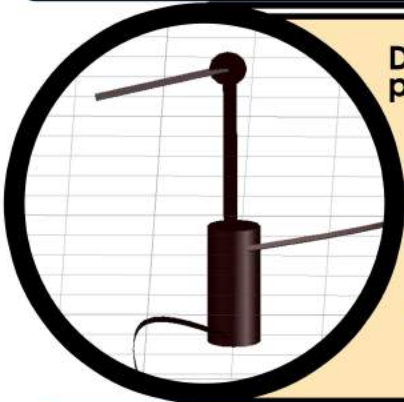
There are 4 pneumatic tanks available on each side of the panel. These tanks are filled with the working fluid R134a. The tanks absorb energy and distribute the gas through the tubes all the way to the cylinders.

For each pair of tanks, they have to gain different amount of energy from the sun. The mirror (blue surface) is there to make sure every tank gain different amount of energy comparing to its pair.



### Double acting pneumatic cylinders

There are 2 cylinders to rotate the panel around two axis. Cylinder arms can perfectly change the direction of the panel constantly to capture the maximum energy.



- The analog solar tracking system
- 1- concave mirror
  - 2- pneumatic tank containing R134a
  - 3- tube
  - 4- double acting pneumatic cylinder
  - 5- wheel

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### CONCLUSIONS

Using green energy has to be more common among people all over the world. Solar cookers need to be easy to operate and cheap to buy. The analog solar system can make solar cookers more wide spread because:

- 1- Panel direction is automatically changed to capture the maximum energy. Once the food is placed, no other help of hand is needed to adjust panel direction.
- 2- Using pneumatic cylinders no electricity or battery is needed.
- 3- Cooking can be done in a shorter time.
- 4- The system is easily affordable.

### REFERENCES

Reference:

1. J. M. Tressler, T. Clement, H. Kazerooni, M. Lim (2002). Dynamic Behavior of Pneumatic Systems for Lower Extremity Extenders. International Conference on Robotics & Automation Washington, DC [2002].
2. Yunus A Cengel, Michael A Boles(2015). Thermodynamics : an engineering approach. New York : McGraw-Hill Education, [2015].
3. Croser, P., Ebel F. (2002); Festo Didactic GmbH & Co., 73770 Denkendorf [2002].