Design and development of a Solar dehydrator

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***Abstract*— The dehydration process is one of the most fundamental techniques in food preservation. This mechanism has been used for centuries, enabling human beings to conserve food in an alternative manner. Currently, the market offers a large number of dehydrating devices capable of producing healthy food. Nevertheless, further development in this field is continually required as customer demand is constantly increasing and food dehydrators have not undergone much development in the fields of sustainability and product design. This paper explains research, development and testing of a recent project, and provides the readers with a possible solution to consumer requirements. The innovative solar food dehydrator is described in detail, along with the technology applied to this device.**

***Keywords*—** Food preservation, healthy food, self-reliance, solar energy, sustainability.

[1] Introduction

THE project consists in developing and building a solar food dehydrator. It is a food processing device which is used to extract moisture from different kinds of foods or herbs. The product is specifically designed for the dehydration of fruit and vegetables. The goal is to develop an optimized and ideal fruit and vegetable dehydrator, encouraging the use of food dehydration as a healthy and efficient method for food preservation.

Around the world, the growing concern about sustainability, self-reliance, healthy diets, and the increasing interest and use of solar energy make our project and our goals as interesting as important. We are developing a product for a very specific and relatively new market niche, which is however rapidly expanding[1]. Our target group – private consumers, such as small farmers, families with a garden or a terrace, or simply any person who is concerned about maintaining a healthy diet and a healthy planet – is one that will keep growing in the years to come.

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The operating mode of the solar dehydrator is quite simple: Fresh, dry air from the outside enters the heating tunnel. With the use of special materials and a metal mesh, this air heats up and rises up the tunnel, through a vent and into the dryer box. By the time the air is inside the dryer box, it is hot and dry. It then flows to the top of the box, going through the metal grids (dryer shelves), thereby extracting the moisture from the thin slices of fruit vegetables that are loaded on these metal shelves. When this air has reached the top of the dryer box, it is very humid, and therefore automatically rejected through the second air vent, located at the top of the box. The decisive element in the process of food dehydration is the constant and controlled air flow, and the transport of humidity. Dried fruit and vegetable generally maintain 8 % to 20 % moisture [2]. In order to achieve the best results, the temperature inside the dryer box should not exceed 70 °C [3]. In addition to this simple system, we have implemented a electrical monitoring unit, or control system, which will be explained in detail in the following chapter.

The main requirements we need to fulfil are the following: The electrical control unit must be powered only by solar energy, the dehydrator must have an efficient design and must be portable, the chosen materials must be sustainable and recyclable, and finally, the product must be user friendly and long lasting.

[2] State of the Art: Solar dehydrator

A. Current Market

Several different concepts of solar dehydrators already exist. Currently, the main competition in the domain of food dehydration can be divided into three big categories:

- Industrial food dehydrators
- DIY (Do It Yourself) dehydrators
- Electrical food dehydrators

In the first category, the dehydrators are used on a larger scale and at an industrial level. However mainly in developing countries such as India in Asia and Senegal in Africa. Companies such as “Shri Industry” and “NRG Technologists” provide the devices and the facilities for drying large quantities of food and/or materials, using only solar energy. Focusing on the example of “Shri Industry”, following observations have been made: Their dryers are conceived to be used on a larger agricultural level, for example by food processing companies (added value in foods such as fruit, nuts, vegetables), but also textile industries (fabric drying purposes). Their dehydrators are the size of small industrial greenhouses. They very much look like greenhouses on the outside, with a not quite transparent surface, which is however permeable to sunlight. There are openings on the top of the boxes, and a space between the material of the box and the ground enables the air to flow properly. The solar dehydrators of “Shri industry” operate only with sunlight, and therefor avoid any power consumption. However, no electronic components are used, so there is no control unit. Their goal is to manufacture modern, yet natural, sustainable and hygienic dehydrators. Shri Industry is based in India, their products are manufactured locally, and are targeted to Indian industries[4]; [5].

The second category of dehydrators are the so-called “Do It Yourself” or “DIY” food dehydrators. As questions of health, sustainability and self-reliance take a growing place in developed countries around the world, more and more people show an interest in building their own solar dehydrator. Research shows that there is an increasing number of websites, books, health magazines or workshops dedicated to themes such as sustainability, self-reliance, renewable energy, and healthy nutrition. Many of those platforms offer the consumers explanations, construction plans or tutorials for building a solar food dehydrator by themselves. Companies such as “SunWorks TM” [6] or “Build It Solar” [7] even sell building kits which contain all the necessary materials and components. The buyer then assembles the given pieces and constructs the dehydrator by himself. “Do It Yourself” solar food dehydrators are very simple devices. The dryer box is usually made out of wood - sometimes out of metal - and one of the surfaces is a glass panel. The dryer shelves are similar to barbecue or oven grids. Air vents are made at the top and at the bottom of the dryer box, in order to let the air flow through [8].

The food dehydrators of the third category are manufactured by companies specialized in kitchen equipment and utensils. These devices have electrical control units that need to be powered by an external power source. As the devices have to be plugged in to power sockets in order to function, they are designed for indoor use. Both the design and the principles of function resemble those of a small electrical oven. In this category, the current market offers products such as “Excalibur - America's best dehydrator” in the USA [9], the “Biochef” dehydrator in Australia [10]. Additional competitors on the current market are: “Stöckli Dörrex”, a Swiss company which manufacture food dehydrators with synthetically drying grids, their price range starting at 109.90 € [11]; “Severin OD 2940”, a German company which produces dehydrators for fruit and vegetable that consume a relatively low amount of energy and sell their product for 50 € [12]; “Sedona TM”, another German company, who sell food dehydrators which require a 550 W power supply, are bigger and heavier, and cost 399 € [13]; finally, the “Bomann DR 435 CB Dehydrator” produced by the German company, requires a 250 W power supply, works with a similar air flow system to our product, and costs 25 € to 40 € [14].

In all these cases, the product itself is not designed to be autonomous or sustainable, and consumes a high amount of energy (a power supply of 250 W to 600 W is necessary for these dehydrators to work), which can become expensive for the user.

B. Innovative Solar Food Dehydrators

Compared to all other related projects and products listed in the paragraph above, the main differences and the innovations brought to this new product are the use of solar energy, the fully autonomous design and the portability.

The device is made of recyclable materials, and it uses a solar panel, connected to a battery, to power the electrical control unit. The control unit is mounted in an additional box, which is connected to the main dryer box. It consists of an on/off switch, an “Arduino Uno” board, a external connection board, a temperature and humidity sensor, a buzzer, an LCD (Liquid Crystal Display) screen, a servo motor and a battery. The sensor measures the temperature and humidity values inside the dryer box and displays them on the LCD screen, for the user to see. By means of the Arduino Uno, the servo motor is programmed to open and close the top air vent automatically, as soon as the temperature and/or humidity levels reach a certain limit. The buzzer is programmed to alert the user after specific durations.

The second special feature is the portability of the dehydrator. The device is foldable and mounted on large, stable wheels, which gives the user the possibility to move the device around easily, indoors as well as outdoors. Thereby, the consumer can make use of as many hours of sunshine as possible.

This solar dehydrator will be manufactured for and used by private individuals, at the same level as a kitchen utensil. It is professionally manufactured and well finished. The user will not need to put assemble the pieces of the device by himself, as it will already come as a finished construct and fully functional device. The dehydrator is optimized for the drying of fruit and vegetables. The drying process takes 6 to 30 hours, depending on the type of fruit or vegetable and on the weather [15].

Summarized, the solar food dehydrator is sustainable, user friendly and offers a simple yet modern control unit.

Table I – Comparison of features and characteristics of related products
(see Annexe, Table 1)

C. Marketing Plan

A market analysis, consisting of a micro and macro analysis was performed. This study resulted in the definition of the company's target group and market segmentation [16].

The target group and market are quite specific: “The Greengineers” company intends to reach out to a modern kind of customer, who is willing and able to invest in a sustainable, energy-saving system to prepare healthy food. Nowadays, modern middle and upper class people of all ages desire healthier, organic food, as they develop a growing awareness and understanding for a natural, healthy cuisine: This is the new “Slow Food” target group. As these people strive to protect the environment by eating responsibly, they are likely to be attracted by an environmentally-friendly solar food dehydrator which will help them fulfil this goal. The addressed consumers are private people - singles, couples or families - who own or have access to a garden or a terrace, and small farmers, who want to dry seeds for the next season's crops, or simply to preserve the surplus of harvested food. The use of this dehydrator also contributes to the reduction of food waste, thanks to its easy preservation through the drying process.

The manufacturing as well as the distribution will remain in Germany at first. This will enable the company to observe the success our product has on a smaller and restricted geographical scale, before deciding to expand their market and export the product to other countries in Europe. Furthermore, limiting the territory of production and distribution, contributes to the reduction of financial and environmental impact of transportation.

[3] Product Development

A. Components and Materials

The components and their functionalities are the following:

Heating tunnel:

The heating tunnel gathers fresh air from the outside through an opening between the wheels. It is made mainly out of pine wood. Only the top surface is glass: Once the tunnel is inclined at the right angle, the sunlight can pass through the glass surface and heat the black aluminium plate that is inside the tunnel. The use of glass for the top surface is justified through its following property: It lets the Infrared sun rays pass through, while blocking out a part of the harmful Ultraviolet-B rays [17]. When the metal plate is hot, it will irradiate this heat to the air inside the tunnel. The hot air will then rise towards the bottom air vent.

Bottom air vent:

Between the top of the heating tunnel and the dryer box, there is an air vent, which lets the hot and,dry air into the box.

Dryer box:

The dryer box is the central part of the dehydrator. It is made out of pine wood. Inside the box, there are five shelves on which the food is loaded to dry. The air that passes trough the bottom air vent rises up to the top of the box, through the shelves, thereby drying out the thin slices of fruit and vegetables. The three decisive parameters inside the dryer box are a constant and controlled airflow, the temperature and the humidity level.

Electronic control and monitoring unit:

The central part of the control unit is the Arduino Uno board. The remaining components are all connected to it: A humidity and temperature sensor measures the values inside the dryer box and displays them on an LCD screen. The LCD screen has some buttons, with which the duration of the dehydrating process can be set manually. Once this duration is over, a buzzer will go off, similar to an alarm. A Servo motor is mounted at the top vent, programmed to open and close automatically, when the dehydrator is switched on or off.

Top air vent:

At the top of the dryer box is a second air vent. Once the air has risen up through the shelves and reached the top of the box, it has a higher level of humidity and will therefor be rejected through top vent.

To sum up the process, the method of dehydration used consists in extracting moisture from fruit and vegetables by means of a controlled air flow system and humidity level.

B. Methods and Functionalities

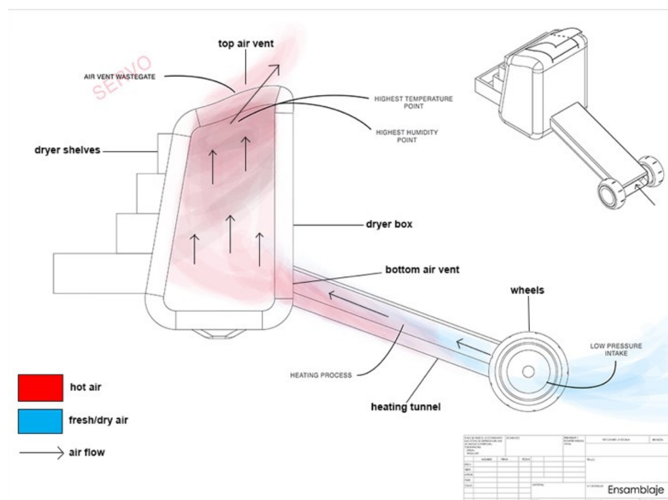


Fig. 1 - Airflow scheme

This picture visualizes the dehydration process. Thinly sliced fruit and vegetables are loaded onto the dryer shelves and into the dryer box. Fresh, dry air enters the heating tunnel through an opening between the wheels. The top surface of the tunnel is made out of glass, allowing the infrared sun rays to pass through, heating up the metal mesh inside the tunnel, which in turn heats up the air on its way up to the first air vent. The difference in density and the inclination of the heating tunnel allow the air to flow upward and into the dryer box.

The bottom vent is located at the point where the tunnel meets the dryer box. The hot air then enters the dryer box and rises upward, passing through the dryer shelves and thereby extracting the moisture from the slices of fruit and vegetables. Once the air has risen to the top of the box and has taken in the humidity, it is rejected through the top air vent. This is a continuous process, and air flow should be constant. It takes an average time of one day (morning to evening) for the food to dry.

C.Product Design and Anthropometrics

The basic system and simple design of a solar dehydrator becomes a challenge, once so many improvements and special features have to be integrated. From the functional point of view, the aim is to maintain the common design of the dehydrators already offered on the market. However, the architecture of the product needs to adapted to these innovative features. The main concerns for the product design are a simple architecture, adapted anthropometrics, such as portability, and a user friendly control unit.

Anthropometrics has to do with the adaptation of every product to the physical properties of the human being. The adequacy of the measurements and other features of the solar dehydrator has the comfortable use towards the final user as its goal. This is the final detail that makes a functional product into a pleasant product.

Primarily, the electronic control system, maintaining the interior of dehydrating chamber in optimum conditions for the drying process is integrated in a box which is mounted outside the dryer box. This additional box can easily be opened and the components can be reached and removed by the user, if necessary. The LCD screen and the buzzer are mounted on the outside of this box, so as to be seen and heard clearly.

The second concern is conferring a character of mobility to the product, adapting the requirements of the product to customer needs.

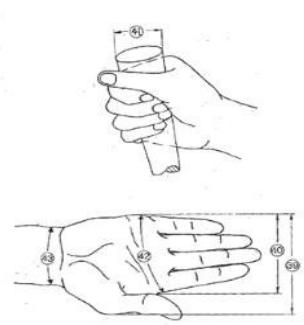
The study is mostly focused on the portability aspect of the product. The determination of the size depends on the physical values of the final user. Females and males are taken into account, in order to realize an universal design. The necessary values are shown in anthropometric studies under the control of international regulations as DIN (Deutsches Institut für Normung).

Table II - Anthropometric main measures

	HOMBRES			MUJERES		
DESIGNACIÓN	VALOR LÍMITE INFERIOR	VALOR MEDIO	VALOR LÍMITE SUPERIOR	VALOR LÍMITE INFERIOR	VALOR MEDIO	VALOR LÍMITE SUPERIOR
EN POSICIÓN ERGUIDA						
A. ALCANCE HACIA DELANTE	662	722	787	662	722	787
B. PROFUNDIDAD DEL CUERPO PARADO	233	276	318	233	276	318
C. ALCANCE HACIA ARRIBA	1910	2051	2210	1910	2051	2210
D. ESTATURA	1629	1733	1841	1629	1733	1841
E. ALTURA DE LOS OJOS PARADO	1509	1613	1721	1509	1613	1721
F. ALTURA DE LOS HOMBROS	1349	1445	1542	1349	1445	1542
G. ALTURA DE LOS CODOS DESDE EL PISO	1021	1096	1179	1021	1096	1179
H. ALTURA ENTRE PIERNAS	752	816	886	752	816	886
I. ALTURA DE LA MANO	728	767	828	728	767	828
K. ANCHO DE HOMBROS ENTRE ACROMIOS	367	398	428	367	398	428
L. ANCHO DE LA CADERA	310	344	368	310	344	368
EN POSICIÓN DE SENTADO						
A. ALTURA DEL CUERPO DESDE ASIENTO	849	907	962	849	907	962
B. ALTURA DE LOS OJOS DESDE ASIENTO	739	790	844	739	790	844
C. ALTURA DE LOS HOMBROS	561	610	655	561	610	655
D. ALTURA DE LOS OJOS DESDE ASIENTO	193	230	280	193	230	280
E. ALTURA DE LAS RODILLAS	493	535	574	493	535	574
F. LARGO DE PANTORRILLA A PIE	399	442	480	399	442	480
G. DISTANCIA DE CODO A PIE DE AGARRE	327	362	389	327	362	389
H. PROFUNDIDAD DEL CUERPO SENTADO	452	500	552	452	500	552
I. DISTANCIA NALGA RODILLA	554	559	645	554	559	645
K. DISTANCIA NALGA PIE	964	1035	1125	964	1035	1125
L. ESPESOR DEL MUSLO	117	136	157	117	136	157
M. ANCHO SOBRE LOS CODOS	399	451	512	399	451	512
N. ANCHO DE ASIENTO	325	362	391	325	362	391

Specifying about the product, two important variables are the size of the handle to carry the solar dehydrator, and the maximum points of mobility of the arm of the user in a rear and extended position.

The diameter of the handle has to be under a maximum value to avoid the hand sliding and over also a minimum value to avoid an excess of weight pressure in the palm or fingers of the user.



Dimensiones en cm	PERCENTIL					
	HOMBRES			MUJERES		
	5%	50%	95%	5%	50%	95%
39. ANCHO DE LA MANO INCLUYENDO DEDO PULGAR	9,8	10,7	11,6	8,2	9,2	10,1
40. ANCHO DE LA MANO EXCLUYENDO EL DEDO PULGAR	7,8	8,5	9,3	7,2	8,0	8,5
41. DIÁMETRO DE AGARRE DE LA MANO*	11,9	13,8	15,4	10,8	13,0	15,7
42. PERÍMETRO DE LA MANO	19,5	21,0	22,9	17,6	19,2	20,7
43. PERÍMETRO DE LA ARTICULACIÓN DE LA MUÑECA	16,1	17,6	18,9	14,6	16,0	17,7

* Las medidas corresponden al anillo descripto por los dedos pulgar e índice

Figura 3.9. *Medidas de la mano (Según Norma DIN 33 402. 2° parte).*

Fig. 2 - Cylinder handle anthropometric measures

In order to determine the height of the solar dehydrator, the optimum angle of movement has to be studied and fitted between the commodity values of mobility of the user arms. By determining the shoulder and hand heights and the maximum angles of mobility a range of correct actuation can be calculated providing the correct position of usability of the product.

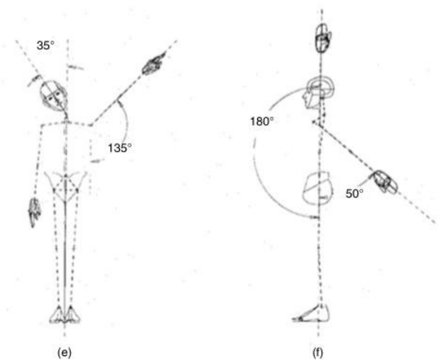


Fig. 3 - Arms angle mobility measures

This is the main anthropometric data to take into account in the final considerations of the physics and shape of the solar dehydrator [18].

[4] Testing and Expected Results

The submission of the product to several tests is required to ensure the correct functionality and security of the product. It is disaggregated in different parts to evaluate, focusing in every system and in the totality of it to detect and evaluate how is every part of the dehydrator performing, differencing between electronic tests, structural tests and finally the process of dehydration itself.

A.Electronic System

Due to the facilities and quickness provided by the electronics, it was the first development and test done in a physical way done in the project of building a solar dehydrator. First of all, the whole of the components where tested to prove their correct functionality, finding a problem in the LCD shield, where the values attached to the buttons had different values than the ones provided in the data sheet. The buttons of the LCD shield work by an emission of a specific frequency that is read by the Arduino when pressed. A program to ensure the correct functionality was uploaded to the Arduino. This program shows you in the LCD a message telling you which button are you pressing, showing in this case imprecise lectures in most of the buttons. Due to the unfamiliarity with that products it was solved by varying the values of frequency in the code and by an attempt and mistake process. Finally the test succeed with every button being correctly recognised by the Arduino.

Fig. 4 – Electronics wire scheme (approximation)
(see Annexe, Fig. 4)

Once each and every one of the components passed the test, a code for the dehydrator had to be written. It was required a very specific functionality, read humidity and temperature values and provide a maintain a specific environment by controlling the movement of a servomotor. First of all was doing a base program with the basic functionality of the system. If the Arduino processor reads values over the maximum required being in terms of temperature or in terms of humidity, it had to send an order to the servomotor. The opposite case had to be considered also. If values are below the maximum required, an order with opposite movement had to be sent to the servomotor. In order to obtain results in an easy way to interpret, have first impressions and prove that every parameter was working correctly, servomotor was obviated and substituted by two LEDs (Light Emitting Diode). Each LED was under the control of different parameters. One under the control of temperature values and the other one under the control of humidity values, so it could be tested that both orders were being interpreted correctly. The lectures of the humidity and temperature sensor were programmed to be shown in the LCD shield to facilitate the evaluation. The result was totally satisfactory. Both LEDs were turning on when the maximum values imposed were exceeded and turning off when values were below the maximum limits.

B.Structural Analysis

The structure is the main concern in terms of product design. Not only the functionality has to be on the correct path, but the security and insurance of long-life is a must. Once the structure of the product is designed it has to be tested in ways as equilibrium stability, structural assembly stability and movability of specific parts of the product.

Once all the parts are built, first test is to ensure the structural static stability of each part just by applying some forces in different directions and points randomly and by an observation method determine if its everything in its correct location and position. Second test concerns the free movement of the movable parts of the product. Parts are moved in translation or rotation movements depending on its functionality to check nothing interrupts the movement. The movable parts checked are the heating tunnel, the legs and the air vent closing. The movement of the legs and the air vent are just checked by observing the circuit are supposed to do, looking nothing interrupts it. A critical point of the design tests is the heating tunnel. The main trouble is not fitting correctly the heating tunnel with the box, allowing air come from the outside to the inside of the dryer box. To solve this problem, bands of rubber are used in the outline of the cavity of the dryer box to avoid any kind of air leak. Finally, an equilibrium stability test is made to ensure the solar dehydrator to be able to stand without falling. This test is done under conditions of a flat and smooth ground in first place, progressing to vary the conditions with different inclinations of the ground and get values from the position limits of the product.

C.Dehydration Process

The dehydration process is the most critical test in the product development. The test consist in submitting the solar dehydrator in a real scenario of work. The theoretical knowledge is proved and errors are ensured to appear caused by the inexperience. The main goal is achieving the maximum temperature expected, oscillating around 65 ºC. The product is placed in the outside facing the sun and values are read through the LCD. Low heat achievements conditions the design of the tunnel to be changed, closing the inner air take by reducing its open area. This fact conditions the air to spend more time in the heating tunnel, what implies more heat caption. Once the maximum heat temperature is achieved, the overheating has to be controlled in order to measure if the air vent out-take is enough. Some more tests have to be done to optimize de function of the servomotor located in the air vent in order to avoid a constant movement if temperature oscillates permanently around the values of dehydration, causing a high rate of power consumption.

Finally, once everything is set up as required, the first real test is done. Food is introduced in the dryer box of the dehydrator and during a long-time test it is proved if it does really works. The main problem of this part of the tests is the long-time required between one test and other, so changes have to be carefully studied to reduce the waste of time during the whole process.

[5] Conclusion

At this point, the solar food dehydrator has been presented in detail, regarding its design, functionalities, special features and the results of preliminary tests. However, the construction phase for the final product is not over yet. Although the control unit has been tested, functional tests on the finished product need to be carried out on a long-term period. Since this solar food dehydrator is the first of its kind on the market, the project is open to any kinds of improvements and must stay under constant development. These future changes will take into consideration technical progress, innovative ideas regarding the design, as well as customer critics and demands.

[6] Figures and Tables

Fig. 1 - Airflow scheme

Fig. 2 - Cylinder handle anthropometric measures

Fig. 3 - Arms angle mobility measures

Fig. 4 – Electronics wire scheme (approximation)
(see Annexe, Fig. 4)

Table I – Comparison of features and characteristics of related products
(see Annexe, Table 1)

Table II - Anthropometric main measures

[7] References

[1] E. Fodor, http://www.motherearthnews.com/diy/solar-food-dehydrator-zmaz06aszraw.aspx, 2006, p. 1.

[2] n.a,http://www.chefkoch.de/magazin/artikel/63,6/Chefkoch/Trocknen-und-Doerren.html, n.d.

[3] n.a, http://en.wikipedia.org/wiki/Food_dehydrator, 2015, p. 1.

[4] n. a, http://www.solardryermachine.com/, 2012.

[5] n.a, http://www.nrgtechnologists.com/Solar_Dryer_Solution/nrg_solar_dryer_fruits-vegetables.html, n. d.

[6] n. a, http://www.solarfooddryer.com/, 2014.

[7] n. a, http://www.builditsolar.com/Projects/Cooking/cooking.htm#Drying

[8] D. Scanlin, http://www.motherearthnews.com/diy/solar-food-dehydrator-plans-zm0z14jjzmar.aspx, 2014.

[9] n. a, http://www.excaliburdehydrator.com/dehydrators/5-tray, 2012.

[10] n. a, http://www.biochef.com.au/biochef-8-tray-food-dehydrator, 2105.

[11] n. a, http://www.perfektegesundheit.de/search/index/sSearch/stoeckli+doerrex/sPerPage/12/sFilter_supplier/7, n. d.

[12] n. a, http://www.severin.de/kueche/kuechenhelfer/weitere-kuechengeraete/obst-doerrautomat-od-2940, n. d.

[13] n. a, http://www.sedona-doerrautomat.de/, n. d.

[14] n. a, http://www.bomann.de/products/de/Webshop/Elektro-Kleingeraete-Webshop/Foodbereiter/Doerrautomat/DR-435-CB-Doerr-Automat.html, 2012.

[15] n. a, http://www.discountjuicers.com/dehydratingtimes.html, n. d.

[16] S. Egbhalian, "Skriptum: Grundlagen des Marketings", 2014.

[17] S.Himberger, http://www.zeit.de/stimmts/1999/199931_stimmts_braunwer, 1999.

[18] J. L. Melo, "Ergonomia practica", First edition, 2009.

[8] Annexe

Table I – Comparison of features and characteristics of related products

	Power supply	Number of Dryer Shelves	Weight	Special Features	Price
Sedona TM	550 W	9	10.6 kg	Digital screen Low noise level	399 €
Bomann DR 435 CB Dehydrator	250 W	5	/	Minimum temperature	25 to 40 €
Severin OD 2940	250 W	5	/	Large shelves, with adjustable height Spacious On/Off Switch	50 €
DIY	No external power supply	*	*	*	Low cost
The Greengineers' Solar Food Dehydrator	Low power consumption Electronics powered by solar energy	5	Light-weight	Temperature and humidity sensor LCD Screen Servo Motor for air vent Buzzer/Alarm On/Off Switch for control unit Wheels Folding mechanism Solar panel	200 to 250 €

* Feature of Do It Yourself dehydrators can vary strongly, depending on the builder's skills and options.

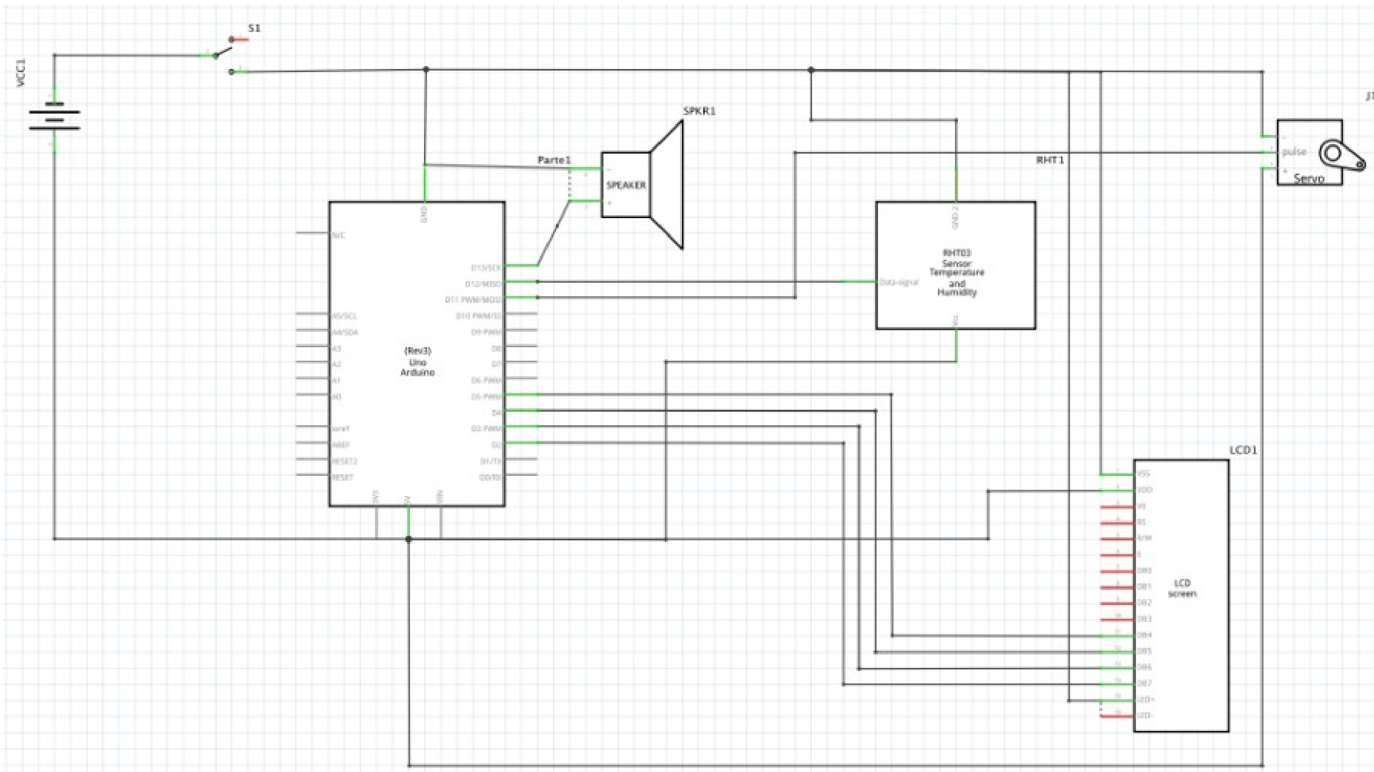


Fig. 4 – Electronics wire scheme (approximation)