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Diseño de un prototipo de contenedor-compactador de latas con muro verde en la Unidad Profesional Interdisciplinaria de Biotecnología

Design of a container prototype - can compactor with green wall in the Interdisciplinary Professional Unit of Biotechnology

Projeto de um protótipo container-compactador de latas com parede verde na Unidade Profissional Interdisciplinar de Biotecnologia

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Resumen

En la actualidad es transcendental reciclar residuos sólidos en las instituciones educativas, pues no se puede ser indiferente ante el cambio climático. En este sentido, la Unidad Profesional Interdisciplinaria de Biotecnología ha emprendido acciones importantes para clasificar residuos, como la creación de contenedores identificados con colores para su separación o garrafones de agua que son usados para rellenar botellas. Dentro de esta institución se cuenta con un comité ambiental constituido por estudiantes, los cuales han realizado jornadas informativas sobre la manera adecuada en que se pueden separare los residuos, aunque estas no han sido del todo efectivas. Por esta razón, se pretende recuperar, potencializar y articular lo trabajado en dicho comité mediante la incorporación de contenedores inteligentes que permitan motivar la separación integral y efectiva de los residuos generados en esta casa de estudios. El objetivo principal de este contenedor-compactador de latas es aumentar el reciclado y aprovechar los residuos sólidos que se generan en la unidad académica. Según la Secretaría del Medio Ambiente y Recursos Naturales, en México se producen alrededor de 42 millones de toneladas de residuos sólidos al año, lo cual equivale a 127 veces el volumen de la pirámide del sol de Teotihuacán y a 231 veces el estadio de futbol más grande de México. Por este motivo, se debe reflexionar y crear conciencia sobre el consumismo en el que estamos inmersos.

Palabras clave: contenedor, latas de aluminio, muro verde, reciclado.

Abstract

Today it is transcendental recycling in schools can not remain apathetic to climate change, we can realize that in some primary and secondary schools are working hard recycling and in what corresponds to higher level. The Interdisciplinary Professional Unit of Biotechnology (UPIBI) has carried out important actions for the separation of waste, such as the placement of containers identified with the colors for their separation, another action is the placement of water bottles to refill their bottles and reduce generation of pet. Within the UA, there is the environmental committee, in which the students who are part of this committee, have held informative days about an adequate separation of waste, but unfortunately have not been completely effective. In order to recover, potentiate and articulate the work, by incorporating the design of intelligent containers, we intend to motivate the integral and effective separation of the waste generated in UPIBI. In order to increase the recycling and use of solid waste and consequently the decrease of these According to SEMARNAT. The waste generated by a person is one kilogram of solid waste a day and in Mexico they generate just over 42 million tons of solid waste a year this amount is equivalent to 127 times the volume of the pyramid of Teotihuacán sun and 231 times the largest soccer stadium in Mexico. For this reason we must motivate the reflection on the consumerism in which we are immersed.

Keywords: container, aluminum cans, green wall, recycling.

Resumo

Atualmente, é transcendental reciclar resíduos sólidos em instituições de ensino, porque você não pode ser indiferente às mudanças climáticas. Neste sentido, a Unidade Profissional Interdisciplinar de Biotecnologia tem realizado importantes ações para classificar os resíduos, como a criação de recipientes identificados com cores para sua separação ou jarros de água que são usados para encher garrafas. Dentro desta instituição, há um comitê ambiental composto por estudantes, que realizaram dias informativos sobre a maneira correta pela qual os resíduos podem ser separados, embora estes não tenham sido totalmente eficazes. Por isso, pretende-se recuperar, potencializar e articular o que já foi feito no referido comitê, através da incorporação de contêineres inteligentes que permitam motivar a separação integral e efetiva dos resíduos gerados nesta casa de estudos. O principal objetivo deste pode compactador-contêiner é aumentar a reciclagem e aproveitar os resíduos sólidos que são gerados na unidade acadêmica. De acordo com o Ministério do Meio Ambiente e Recursos Naturais, no México cerca de 42 milhões de toneladas de resíduos sólidos são produzidos por ano, o que equivale a 127 vezes o volume da pirâmide solar de Teotihuacán e 231 vezes o maior estádio de futebol. do México. Por esta razão, devemos refletir e criar consciência sobre o consumismo em que estamos imersos.

Palavras-chave: recipiente, latas de alumínio, parede verde, reciclado.

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Introduction

Most of the definitions regarding the concept of garbage coincide in pointing out that they are all wastes that are produced as a consequence of human activities, whether domestic, industrial, commercial or service. These wastes, from their accumulation, generate serious ecological problems due to the fact that garbage dumps become permanent sources of contamination.

Now, although it is true the recycling of these waste contributes to minimize these negative impacts, it is also true that not everyone fulfills this task. Therefore, in the specific case of the Interdisciplinary Professional Unit of Biotechnology (UPIBI) a container-compactor has been created as a prototype, which, through a manual process, allows to compact and recover cans to promote social and environmental welfare. In addition, this initiative has included the integration of a green wall that seeks to promote a friendly attitude to the environment.

This initiative arises because the World Health Organization (WHO) has recommended that in cities there are between 10 m2 and 15 m2 of green spaces per inhabitant, although the reality shows that there are few urban centers that meet this minimum limit proposed, hence the green covers represent an option for the environmental balance. In effect, the installation of green walls has as an advantage the regulation of temperature, the reduction of stress in people and the embellishment of spaces. In the words of Velázquez (2014), the generation of green spaces contributes to the reduction of environmental pollution and increases social and individual well-being.

Development

The compaction is the process by which a force is applied to a material of low density - in this case, aluminum cans - to compress the air that is in its empty spaces. This allows the material to have greater density and smaller volume, which facilitates its storage and transport. Although most waste compactors use hydraulic energy to perform their task, some are electric or manually operated, such as the one proposed in this paper. The proposal of the container-can compactor is able to reduce up to 20% of its size, and does not require previous separation of the container, since it is designed only for aluminum cans.

The following are the three stages that constitute the materialization of this proposal:

1. Container and can compactor design.
2. Design of the green wall.
3. Automation for irrigation.

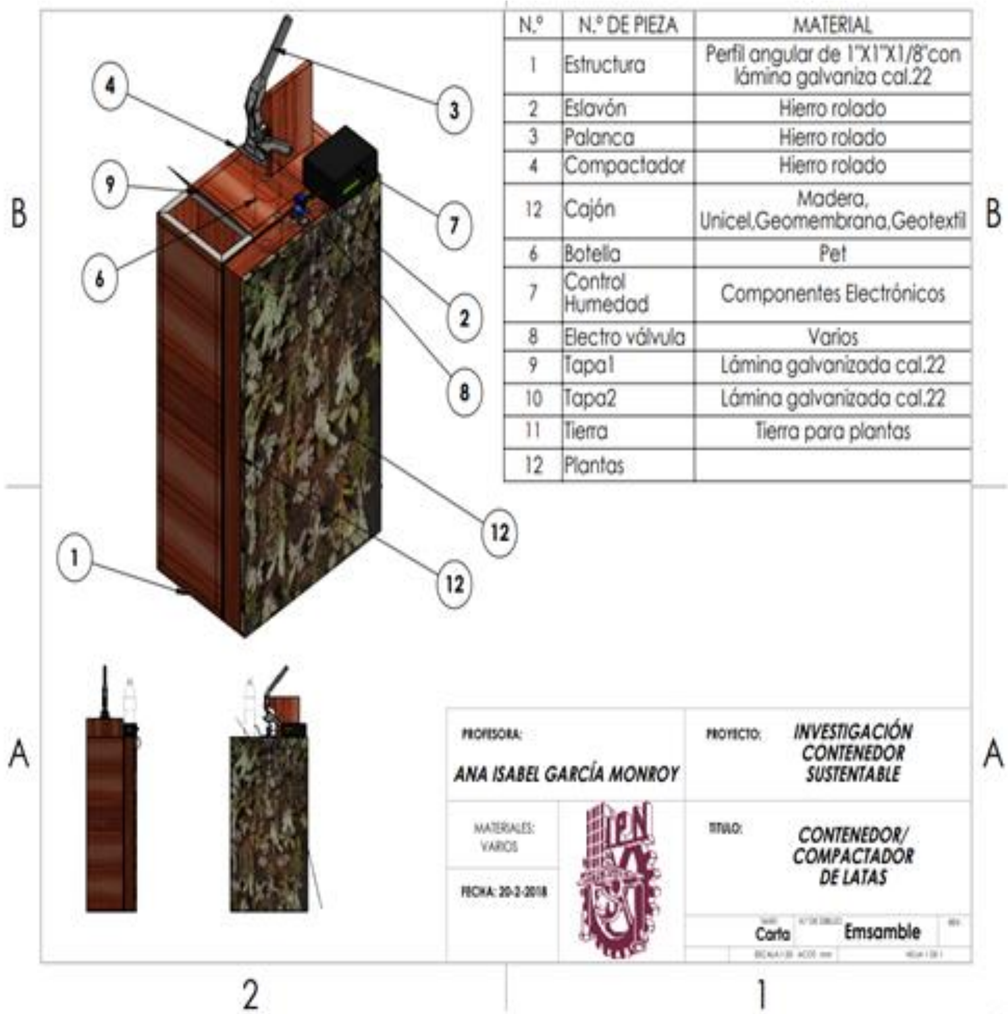
Stage one: container design and can compactor

The design of the prototype implemented in the UPIBI aims to compress and facilitate the recycling of 355 ml aluminum soda cans.

Required material

Figure 1 shows the materials that make up the prototype.

Figura 1. Material requerido para la construcción del contenedor y compactador de latas



N.º	N.º DE PIEZA	MATERIAL
1	Estructura	Perfil angular de 1"X1"X1/8"con lámina galvaniza cal.22
2	Eslavón	Hierro rolado
3	Palanca	Hierro rolado
4	Compactador	Hierro rolado
12	Cajón	Madera, Unicel,Geomembrana,Geotextil
6	Botella	Pet
7	Control Humedad	Componentes Electrónicos
8	Electro válvula	Varios
9	Tapa1	Lámina galvanizada cal.22
10	Tapa2	Lámina galvanizada cal.22
11	Tierra	Tierra para plantas
12	Plantas	

Fuente: Elaboración propia

As seen in figure 1, the system is formed by a crank-type mechanism, and has approximate dimensions of 0.63 m x 0.30 m x 1.06 m. The introduction of the cans to the compacting mechanism is done manually; for this, the can is placed vertically under the compaction cap. Then, the user must press with the crank to compress the can, which is deposited inside the compactor to start the process again. Given the previous study carried out in the UPIBI community, the design of a can compaction system has been proposed, as shown in figure 2.

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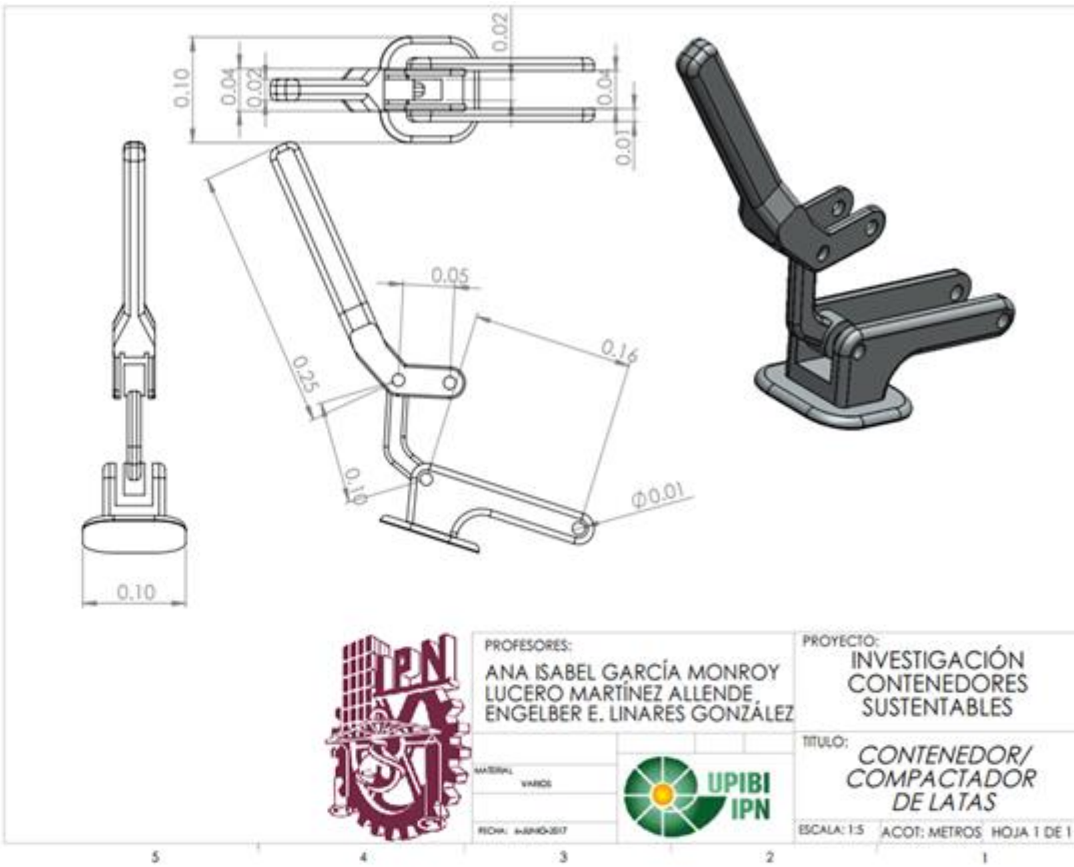
Figura 2. Sistema de compactación de latas



Fuente: Elaboración propia

The proposed design, in addition to promoting recycling, aims to raise awareness among the community of the importance of optimizing waste produced by aluminum packaging, in addition to taking advantage of the prototype structure to integrate a green wall, whose purpose is to improve the environment within the academic unit to make it more pleasant and clean.

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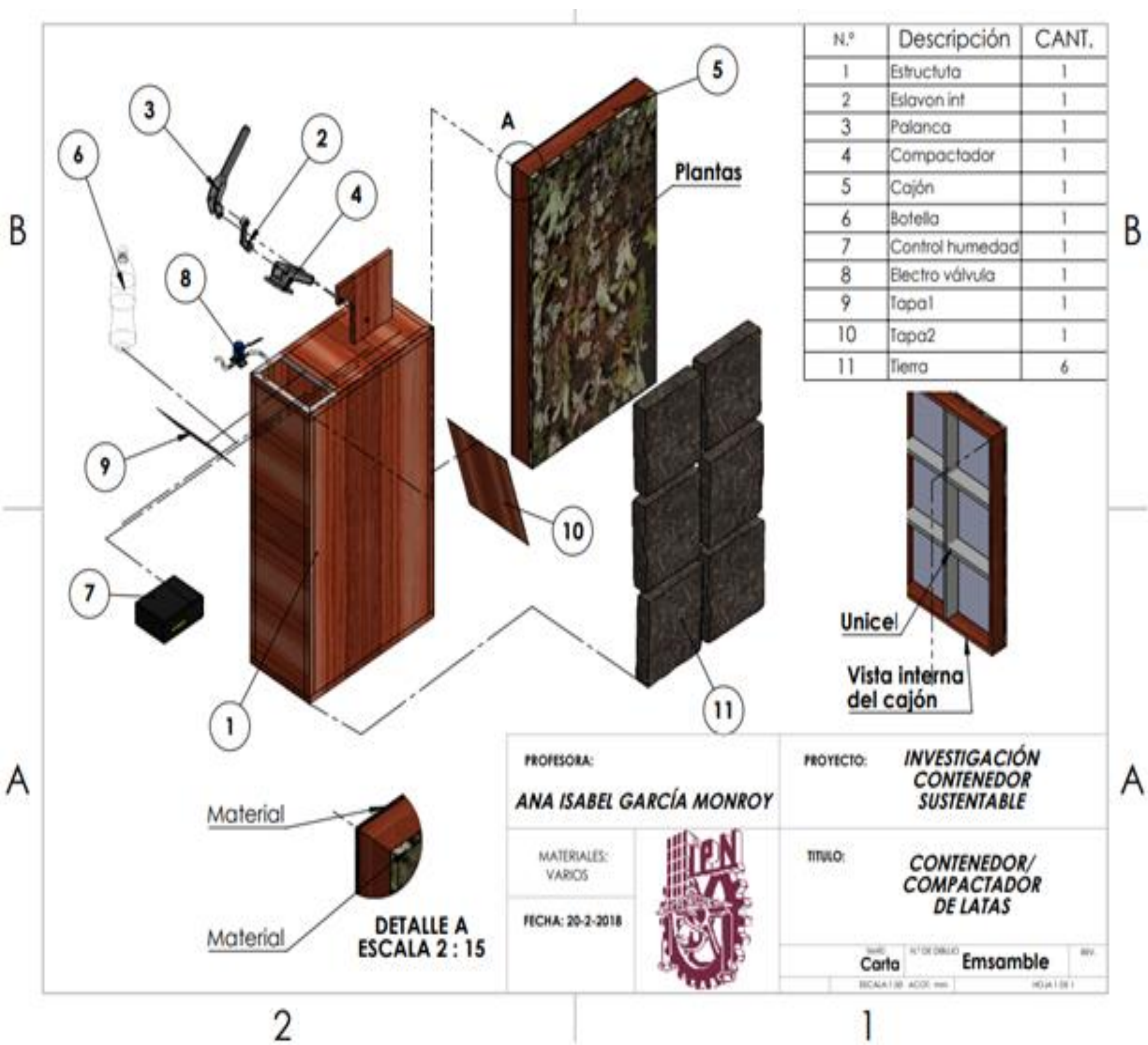
Stage two: green wall

A wall of culture or green wall is a vertical installation covered with plants of various species that are cultivated in a special structure to give the appearance of a garden, hence it is also known as a vertical garden. The green wall has a great versatility in terms of shapes and vegetation, so it can be adapted to public spaces. The required material can be seen in figure 3:

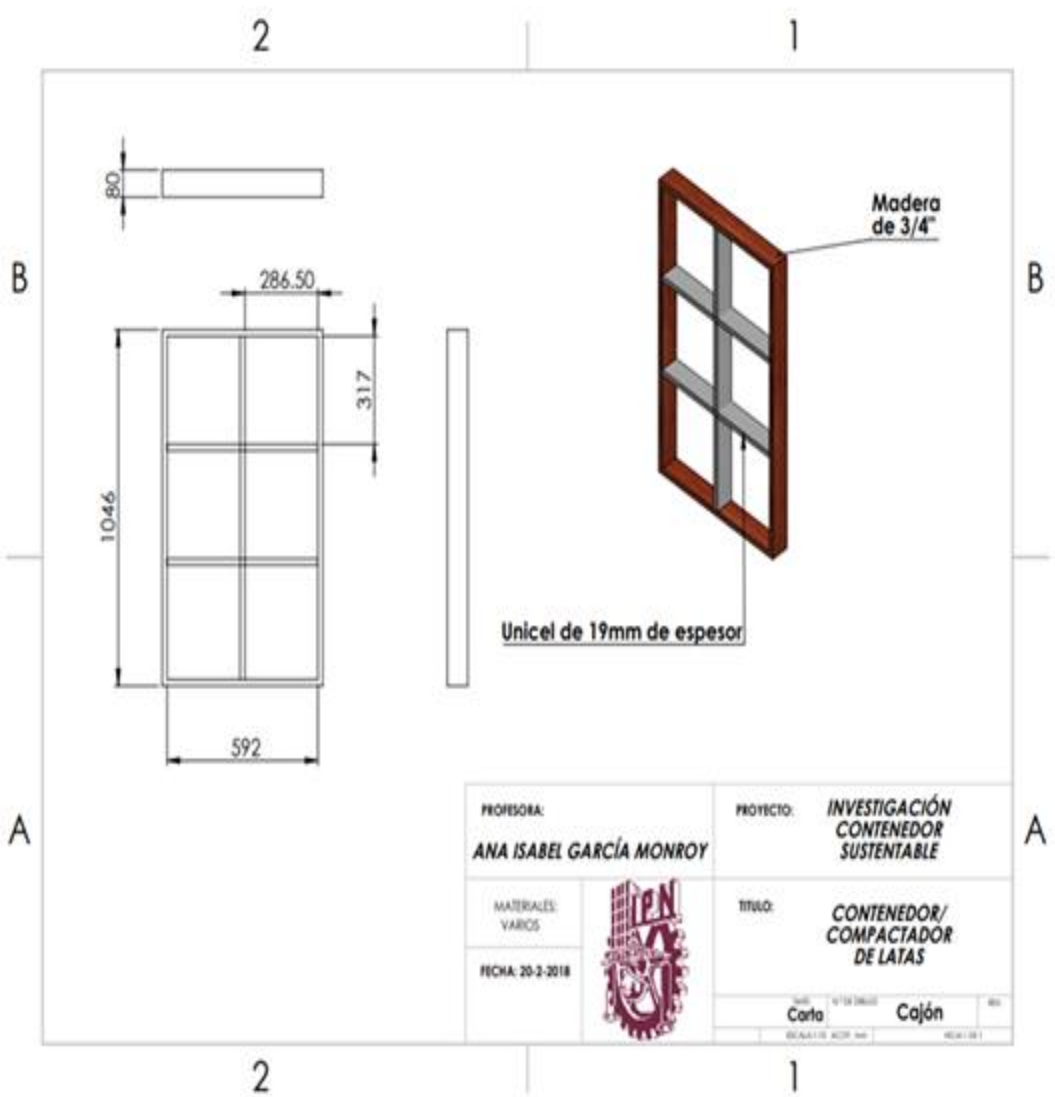
Figura 3. Muro verde



Fuente: Elaboración propia

To support the plants in the green wall we propose a wooden structure that can be waterproofed and lined with moisture-resistant geotextile. To support the plants, expanded polystyrene can be used, as well as a geomembrane, whose function is to prevent the possible filtration of water into the system, as can be seen in Figure 4:

Figura 4. Colocación del poliestireno expandido (Unicel)



Fuente: Elaboración propia

A culture medium should have optimal physical properties, such as aeration, drainage, water retention and low wet weight by volume (apparent density). Most of the substrates used in the production of ornamental plants consist of a combination of organic and inorganic components, as shown in Figure 5:

Figura 5. Colocación del sustrato

Fuente: Elaboración propia

In figure 6 the geotextile is shown. This has the task of containing and maintaining humidity in the plants, which improves the mechanical properties of the soil thanks to its resistance to traction or perforation.

Figura 6. Colocación del geotextil

Fuente: Elaboración propia

The vertical garden or green wall will be constituted by plants of the family Crassulaceae, since Mexico is the country with the greatest richness of these species with 913 taxa, of which 80% are endemic to the country. In the design of the wall of life they emphasize species like Echeveria mondragoniana, Echeveria laui, Echeveria dactylifera, Pachyphyutm, Sedum morgarianum (see figure 7).

Figura 7. Colocación de las *Crassulaceae*

Fuente: Elaboración propia

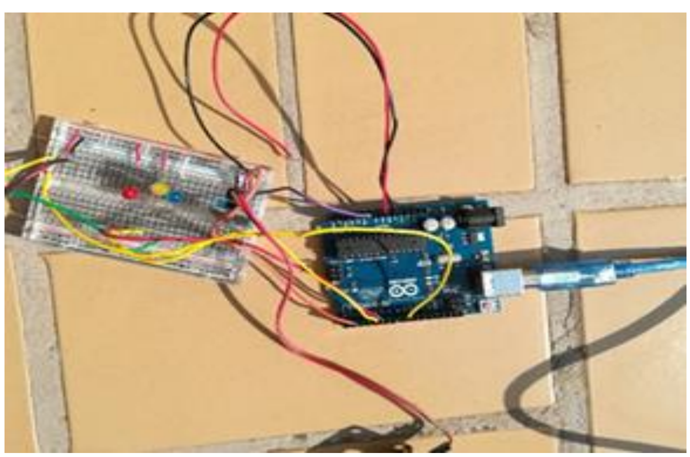
Stage three: irrigation system

In what corresponds to the irrigation system, the amount of water used by the plants depends on the climate, the water content in the soil and the cultivated species. The determination and monitoring of soil moisture is essential to solve problems linked to the irrigation needs of crops. As mentioned by Edward (2010), soils have different capacity to store water depending on its texture and structure.

The upper limit of water storage is called field capacity (CC), while the lower limit is called permanent wilting point (PMP). The CC is the water content in the soil after heavy rain or heavy watering, when the speed of the drain changes from fast to slow. PMP is defined as the moisture content of the soil in which the plant no longer has the capacity to absorb water, which causes it to wilt and die if water is not provided. The amount of water that can be absorbed by the crop is called plant available water (ADP), which is the difference between CC and PMP, which is usually expressed as a percentage by volume. The irrigation system is the set of structures that allows to determine which area can be cultivated by applying the necessary water to the plants. It is important to control humidity in the system to optimize water consumption and achieve better performance, hence it is essential to make soil moisture measurements in real time. The stages of the control system are the following:

- The entrance to the system is the optimum humidity for the plant.
- If humidity is high, the Arduino IDE run code identifies the humidity sensor signal and turns on the blue led light. Then, it sends the correction signal for the 180 ° position for the servomotor (valve closed).
- If the humidity is medium, the orange led light turns on, which is a warning signal to the user that the humidity is going down. Subsequently, it sends the negative correction signal of the 180 ° position for the servomotor (valve closed).
- If the humidity is low, the blue led light turns on (signal for the positive servomotor) and the correction signal of 0 is sent for the servomotor (open valve). When the humidity sensor detects again that humidity is high, it closes. Next, you can see the circuit in figure 8.

Figura 8. Circuito del sistema de riego



Fuente: Elaboración propia

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Figure 9 shows how the control system of the green wall irrigation system is installed.

Figura 9. Colocación del sistema de riego

Fuente: Elaboración propia

Figure 10 shows the integration of the irrigation system in the can container-compactor.

Figura 10. Sistema de riego

Fuente: Elaboración propia

Discussion

The recycling of aluminum cans is very important because the extraction of aluminum involves a large environmental cost. In fact, to obtain a ton of aluminum, it is necessary to extract some 4000 kg of bauxite (mineral found in the subsoil of the forest) and 500 kg of petroleum coke. However, if the existing cans are used to manufacture new containers, the necessary energy is reduced by 90% to that used in the initial processing. In addition, the air pollution that is generated in the recycling of aluminum cans is 95% lower.

These benefits have been received by the Mexican company Arzyz, which has invested 50 million dollars in advanced technology to recycle aluminum in that country, and estimates that it will give new use to 120,000 tons of aluminum per year, which will prevent generation of approximately 264,000 tons of CO2 derived from the production of primary aluminum. With the energy required to produce a primary aluminum can, 20 cans of recycled aluminum can be manufactured. On this aspect, it is worth noting that the countries that lead the world in the recycling of aluminum cans are Brazil (98%), Japan (93%), China (90%), Europe (64%) and the United States of America (58%).

Below is a comparison of the existing can compactors and the proposed design:

1. A compactor for recovering aluminum cans has a removable vertical tube that fits into a slot in the base; A replaceable anvil has an arcuate groove that fits over a section of the groove mentioned above, and the tube wall passes through this groove to reach the groove. A push rod carrying a shredding block is hingedly connected to a lever arm by means of a U-bolt, so that it can remain substantially vertical.
2. 2. Aluminum can compactor and method: A can compactor in which there is a relative movement between a cam and a can, in a direction generally tangential to the can. This relative movement progressively collapses the sides of the can, after which the ends of the can bend more than it was as a result of the collapse of the side of the can. As previously mentioned, the existing compactors are similar to the proposed design, but the purpose is not only to compact containers, but to generate awareness of the consumerism generated over time and an environmental improvement, by

incorporating a container with a green wall that It has an irrigation system. To this is added a sign with the following question: "Did you know that aluminum cans take 10 years to degrade and that with the energy required to produce a primary aluminum can, 20 recycled cans can be manufactured?" It can be indicated, therefore, that the incorporation of environmental awareness programs is required, since every day in Mexico approximately 20 million cans of aluminum are thrown away, which is equivalent to 180 cans per year per person. This means that if everyone recycles only 10 cans of aluminum per year, they would save about 300 million pesos in raw materials.

Conclusions

With the construction and start-up of the container-compactor, the aim is to encourage recycling and reflection on the amount of waste generated within the UPIBI. Therefore, it is important to implement other containers to promote participation. It is expected that with the incorporation of the interactive container the community of UPIBI will be integrated in the proper separation of solid waste and in the care of the green wall.

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