Spectrum Journal of Innovation, Reforms and Development
Volume 20, October, 2023 | ISSN (E): 2751-1731
Website: www.sjird.journalspark.org

THE EFFICIENCY OF USING A SMART GREENHOUSE IN THE OMAD FARM IN THE YANGIBAZAR DISTRICT OF THE KHOREZM REGION

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Abstract
This article describes the methods of using a smart greenhouse in the Omad farm in the Yangibazor district of the Khorezm region, its operation in accordance with the climate and methods for obtaining such a high-quality and abundant harvest.

Keywords: agriculture, smart greenhouse, design, sensor, microclimate, exposure meter.

Introduction

A smart greenhouse significantly facilitates the physical labor of a gardener. She is able to independently take care of the future harvest of cucumbers and tomatoes, berries, or other crops, without the participation of the owner. A set of automatic options frees a person from many hours and daily maintenance of beds, reduces labor costs.

Let's consider further in the article what requirements the "smart greenhouse" meets, what technologies are used in its manufacture, the varieties of such greenhouses, and how to choose the right models, all the poles and cons of this design, alternative options, as well as the possibility of creating a "smart greenhouse" with your own hands.

"Smart greenhouse" is an automated greenhouse design that guarantees significant relief of the difficult process of growing crops and caring for them, as well as minimizes the use of manual labor.

The Smart greenhouse is able to independently maintain the required microclimate, control temperature and ventilation, provide regular and metered irrigation of plants, and supply fertilizers.

"Smart greenhouse" has a wider functionality in comparison with the traditional version. It allows you to increase productivity, thanks to the presence of automatic mechanisms in the design, which are controlled and controlled using modern software. The original design of the greenhouse allows for maximum illumination of the cultivated crops.

Each "smart greenhouse" in its configuration must have:

- ✓ sensors;
- ✓ actuators with mechanisms;

✓ tracking and management systems (fig.1)

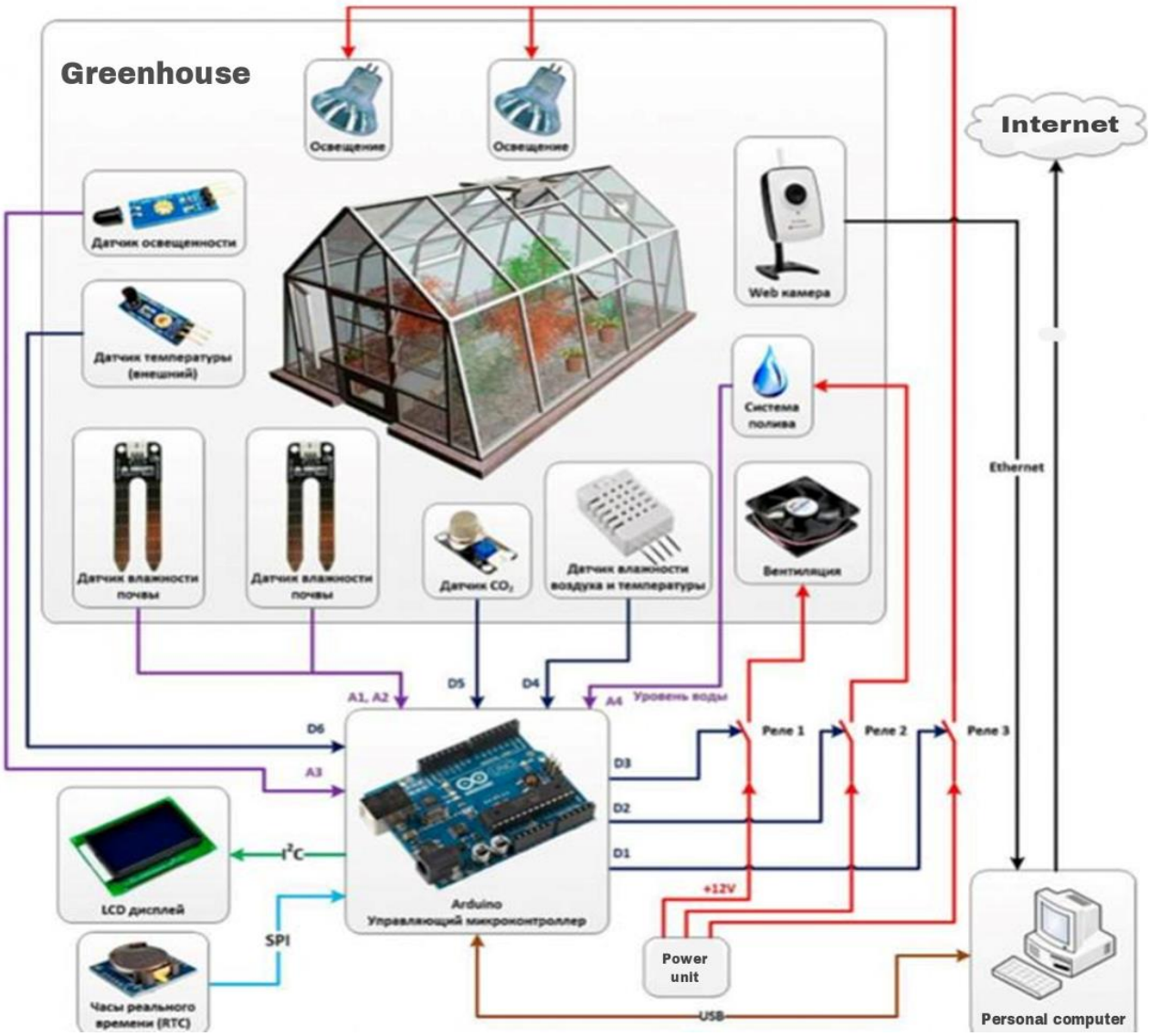

Fig.1[1]

The entire structure as a whole is fully automated, with the available microcontrollers, necessary instruments, measuring instruments and applications (with the Internet) available for possible remote viewing and adjustment of indicators.

The main task of the "smart greenhouse" is to create the most comfortable microclimate for the growth and development of plants, which ultimately contributes to abundant and friendly harvests of delicious vegetables/ fruits/ berries, etc. cultures.

A modern greenhouse will correspond to the status of "smart" if it has the following modern technologies in its design.

[1] https://agronom.guru/ogorod/teplitsyi/vidy-t/umnye

The efficiency of using a smart greenhouse in the “Omad farm” in the Yangibazar district of the Khorezm region, HVAC equipment is used.

This equipment includes a complex of several components:

- ✓ ventilation system;
- ✓ air conditioning;
- ✓ heating system.

HVAC equipment guarantees the maintenance of ideal temperatures that allow you to grow vegetables and plants in the greenhouse all year round. The system can be configured to cultivate a specific vegetable or exotic plant. The undeniable advantages of HVAC are the minimization of operating costs. It is one of the best and most in-demand technologies (Fig.2).

Fig. 2

LED lighting, or LED lighting is considered the most preferable, since it has (Fig. 3):

- ✓ compact dimensions;
- ✓ minimum weight;
- ✓ great design;
- ✓ simple installation;
- ✓ cost-effectiveness at work;
- ✓ long service life.

Fig. 3

LEDs simulating daylight can provide additional lighting (anywhere in the greenhouse) to plants in minutes.[4]

At the request of the owner of the "smart greenhouse", the sensors used in the design can be used in any combination:

- for measuring humidity in soil and air;
- temperature;
- exposure meter – to determine the brightness of greenhouse lighting;
- to obtain data on the acidity of the soil, and its chemical composition;
- for preliminary determination of t of water for irrigation or water quality.
- Taking readings, their frequency and frequency can be adjusted.

Wireless or wired networks are used to connect all sensors. In especially remote localities, you can choose the LPWAN wireless technology (long-range network). It copes well with the transfer of small, in terms of volume, data.

NB-IoT, LoRaWAN, RF show themselves well. This type of communication does not require the use of a licensed range network, this guarantees a low cost of maintenance and maintenance of equipment (Fig. 4).

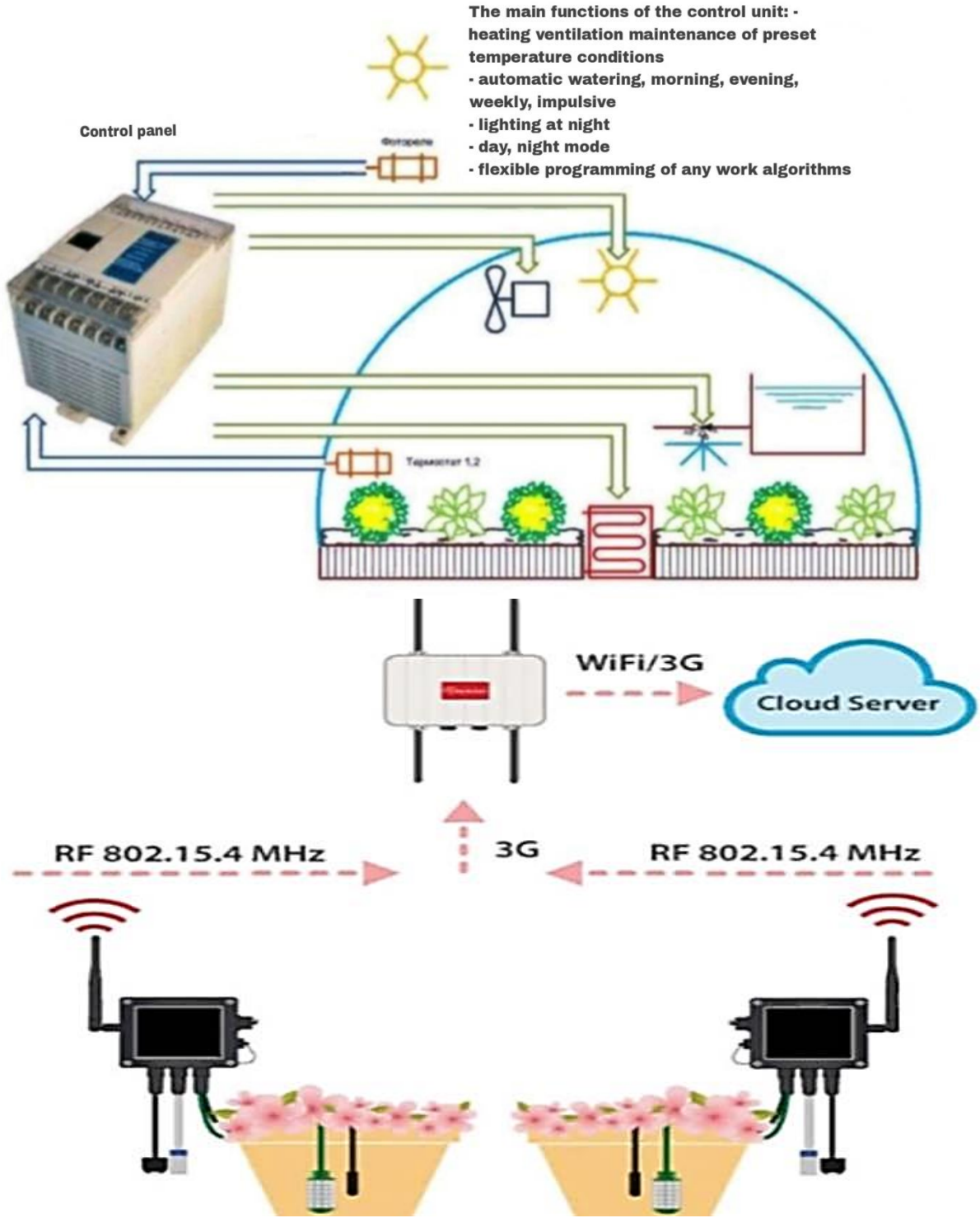

Fig. 4

Specially designed applications for managing the "smart greenhouse" can be easily installed on:

- ❖ smartphone;
- ❖ PC;
- ❖ tablet with laptop.

The interfaces are clear and easy to use. The owner with the help of a gadget at a distance will be able to monitor the operation of the system, monitor the indicators in "live mode", change them if necessary.

The automatic "smart greenhouse" makes it possible for the owner not to be on the ridges all day, but to do more important things, or spend time on rest. The work of the structure can be controlled from a distance using gadgets.

The advantages of smart greenhouses are that throughout the year, it becomes possible to consume fresh vegetables/ fruits, or grow them for sale. The variety of varieties of models, allow you to choose the most optimal option for everyone. Smart greenhouses are divided according to the following criteria.

The frame material must be durable and resistant to temperature changes, precipitation, installation of additional insulation material. The frame can be:

Made of steel – the most durable and sturdy option. It is covered with a protective layer against corrosion, or galvanizing.

Aluminum – resistant to rust, easy to process. But this material is not strong enough for heavy loads. With abundant snow cover in winter, strong gusts of wind can change shape, become unusable.

Made of wood – not expensive, but prone to rot. Over time, even when treated with protective means, the frame will sag.

The frame should be selected in accordance with the size of the greenhouse, the larger it is, the stronger the frame should be.

Greenhouses according to the coating material can be:

made of cellular polycarbonate – light, durable and transparent, with resistance to UV rays (density from 0.65 g / m3, thickness from 4 mm or more);

of capital walls with a roof and glass;

completely glass;

combined – from a combination of different materials (Fig. 5).

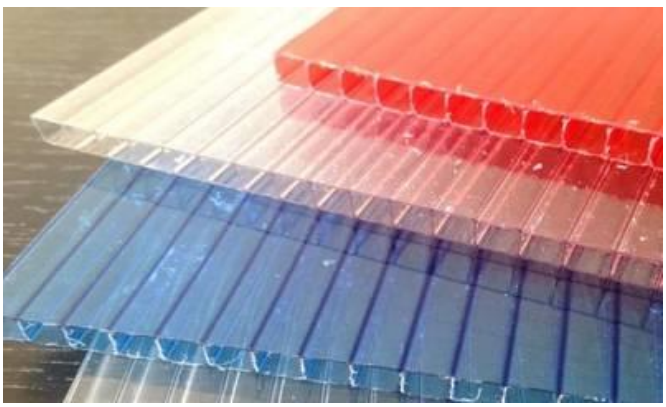

Fig. 5

You can choose any version of the greenhouse roof:

Lean – to is a compact and simple option, suitable for small plots and greenhouses of small or medium size.

Gable roofs – occupy a lot of space, suitable for large greenhouses, the maximum height in the center of the greenhouse. The roof will provide independent precipitation, thanks to the slopes.

In the form of arches – the classic version. The model is wind-resistant. The internal space is used as much as possible and with benefit. The frame must have super-strong qualities, since snow can accumulate on the roof, which should not destroy the structure.

New items in the form of a spherical roof began to appear on sale. This type is compact, has a low weight, and guarantees excellent lighting. The roof type is well resistant to loads.[3]

One of the main criteria when choosing the type of construction is the step between the arches, the smaller it is, the stronger the greenhouse.

The walls of the greenhouse can be straight, rounded, or any geometric shape. The most popular material for walls is cellular polycarbonate – it is affordable and easy to install. Glass walls will be expensive, it is a heavy and fragile material. It is recommended to use a film for walls for seasonal, summer options.

The greenhouse can be installed with a different type of structure:

Sliding structures are convenient because they can be partially opened in the hot season by shifting individual elements (Fig. 6).

Fig. 6

Collapsible – the design allows you to completely disassemble and reassemble the greenhouse for the season, or move it to a new location. This type makes it possible to remove individual modules of the structure.

Stationary models are mounted on a solid foundation at a pre-selected location. They are equipped for use within 12 months. You can install a heating system.

Depending on how many plants are supposed to be grown (for sale, or just for yourself), you should also choose the sizes of greenhouses, which can be wide:

- 1.5-2 m;
- 3-3.5 m;
- 4-5 m.

The height and length of the greenhouse can be different, depending on the crops grown from 1.5 m to 9 m and above. The greenhouse can also have a square, rectangular, rounded shape.

When choosing a smart greenhouse, pay attention to the following important factors:

- ❖ which crops will be grown in the greenhouse (purpose) – this determines the size of the structure and shape;
- ❖ tent, gable model is suitable for growing tall crops;
- ❖ the design in the form of an arch is characterized by durability, ease of operation from the inside;
- ❖ for regions with a large amount of precipitation, it is advantageous to take an arrow-shaped model (roof);
- ❖ the galvanized profile construction is the most durable and strong;
- ❖ when choosing a greenhouse, pay attention to the strength characteristics – they are expressed in the stability of the frame to wind / snow load;
- ❖ the ways of connecting composite modules affect the durability of the greenhouse;
- ❖ the most important parameter is the density, thickness and bandwidth of light.

The presence of all components of an automatic system for a "smart greenhouse" guarantees minimal physical and time costs of a person, and good crop yields. The degree of automation of the greenhouse can be selected independently or choose standard options. It is necessary to take into account the volume of plants grown – for the family, or for sale.

In winter, it is also possible to "remake" wide, roomy window sills into greenhouses. They are suitable not only for seedlings. Lettuce leaves, dill, parsley, individual varieties of tomatoes or cucumbers can be grown on the windowsill. The main thing is to provide the plants with heat, irrigation and plenty of light.

If there is a winter garden in a country house, it can be partially used during the cold period for growing fresh vegetables and herbs. Insulated loggias on the south side of the house are also in demand as a year-round greenhouse.

Conclusion

"Smart greenhouse" is a modern, cost-effective design equipped with an automatic microclimate adjustment system. Thanks to the arrangement of monitoring sensors and timely adjustments in changes in indicators (temperature, humidity, fertilizer availability, etc.), the greenhouse is able to independently "monitor" growing plants, taking care of them in time.

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