

Smart Greenhouse for Enhanced Farming**Ekta Kamboj**

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SUMMARY

The smart greenhouse is a revolution in agriculture, creating a self-regulating microclimate suitable for plant growth and development through the use of sensors, actuators, monitoring and control systems that optimize growth conditions and automate the growing process. Benefits of our Smart Greenhouse helps in creation of the right environment for better yield, uses the water appropriately according to the crop needs, monitoring resource consumption and controlling, automating and detecting plant growth. Major reasons for the growth of smart greenhouses are increasing adoption of Internet of Things (IoT) and artificial intelligence (AI) by farmers and scientists; growing demand for food owing to continuously burgeoning global population; rising adoption of indoor farming in urban areas; and rising number of government initiatives to promote the adoption of smart agricultural practices.

INTRODUCTION

Amid global climate change, dwindling resources and increasing population, the world farming business is seen under vital pressure. As the unpredictability intensifies, it's no surprise that growers are looking forward to advanced technologies to pace production efficiency and crop resilience. In agriculture, the Internet of Things (IoT) is more utilized than ever before, and smart greenhouses are an excellent example. A greenhouse provides a controlled environment customized to the needs of crop grown inside. Traditionally, micro-climate and agronomic parameters were recorded in a rather manual and varying manner. There is a limit to what can be measured and farming practices are performed on a pre-defined schedule. Whereas, weather changes throughout the day and "invisible" conditions like open doors or early-stage infection perpetually influence the greenhouse environment and threaten the crops.

Benefits of Smart Greenhouses for Crop Growers

Equipped with trending sensing element and communications technologies, smart greenhouses automatically capture and deliver whole day information on the environment and crop. Collected data is fed into an IoT platform and analytical algorithms convert it into actionable intelligence to reveal bottlenecks and abnormalities. Accordingly, HVAC and lighting operations, alongside irrigation and spraying activities can be controlled on demand of the crop. Continuous data monitoring facilitates in developing predictive models to assess crop disease and infection risks. By unlocking massive crop insights, a smart greenhouse permits growers to reduce labor work, improve resource and chemical use efficiency while optimizing yields.

Maintain Ideal Micro-Climate Conditions

IoT sensors enable farmers to gather various data points at unprecedented granularity. They provide real-time information on critical climate factors like, temperature, humidity, light exposure and CO₂ across the greenhouse. This data prompts relevant changes to HVAC and lighting settings to maintain the optimal conditions for plant growth while driving energy efficiency. At the same time, motion/acceleration sensors help identify doors that are involuntarily left open to ensure a strictly controlled environment.

Enhance Irrigation and Fertilization Practices

Smart greenhouses ensure irrigation and fertilization activities are in balance with the actual needs of cultivated plants for maximized yields. Based on acquired data, sprinkler and spraying systems can be automatically turned on to meet real-time crop demands while minimizing manual intervention.

Control Infection and Avoid Disease Outbreak

Crop infection is a persistent farming challenge. Agrochemical treatments did too frequently raise ecological, safety and cost concerns, while failing to use or late application could lead to disease outbreaks.

With the help of a machine learning platform, data on external weather and soil characteristics and greenhouse environments reveal scope for existing risks of pest and diseases. With the help of this information, farmers can apply treatments exactly when needed to ensure a healthy crop at the least cost.

Prevent Thefts and Improve Security

Greenhouses with high-value crops can be a target for thieves. In this context, IoT sensors in smart greenhouses provide an affordable infrastructure to observe door status and detect suspicious activities. Connected with an automated alarm system, they instantly alert growers when a security issue arises.

Building Blocks of a Smart Greenhouse

- a) Low-energy consuming battery-operated sensors to capture varied environmental, agronomic and security data points.
- b) Reliable, cost-efficient wireless connectivity to transmit data from cross-greenhouse sensors to a remote gateway.
- c) A diagnostic, machine learning platform to extract intelligence from sensor data and visualizes it on preferred UIs to make well-versed decisions on farming activities. The platform can also be integrated directly into existing greenhouse control systems to initiate programmed actions on HVAC, lighting, sprinkler and spraying networks.

CONCLUSION

With a forecasted market value of more than USD 2.1 billion by 2025 from USD 1.4 billion in 2020; it is expected to grow at a CAGR of 9.2% from 2020 to 2025. Smart greenhouses aren't any doubt a significant farming trend to look at. A smart greenhouse brings new IoT technologies and conventional agricultural systems together for complete visibility and automation. It helps pinpoint inefficiencies and combat problems that have long plagued farming operations to safeguard crops and maximize yields.

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