

# A Survey on Greenhouse Temperature and Regulation Using Iot Technology

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**Abstract :***In this world of modern technologies IoT is providing efficient ways to ease our day to day tasks .We are surveying a paper based on a highly scalable intelligent monitoring and controlling system for greenhouse environment. We are considering a model that is highly energy-efficient and scalable.This technology even helps to improve production quality of crops in the countries with extreme climatic condition.The information obtained by this system can be further analysed and studied for further improvements this can be achieved by using IoT sensors using a dynamic graph data model.The major role played in this research is by Petri-Nets models which basically monitors and also helps to create reference temperature.The project and research is in the form of model driven architecture.*

**Keywords:** *Intelligent greenhouse agriculture, temperature control system, the Internet of Things (IoT),Petri nets (PNs), graph database, model transformations, model-driven architecture (MDA).*

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## I. INTRODUCTION

Agriculture and its development through years has been visible with the help of modern agriculture technologies. In the regions with extreme climatic condition such as kingdom of Saudi Arabia which is a desert.Average temperature in july is around 43 °C while in January it nearly goes down to 14°C,so it becomes difficult to cultivate crops in such conditions .

Crops like tomatoes,cucumbers,sweet peppers and strawberries require optimum temperature in the range between 11°C to 28 °C. From this temperature range we realize that it is necessary to meet certain standard of requirements for production of good quality crops ,these standards can be mentioned as temperature,humidity,CO2 levels and light intensity.

The Internet of Things here plays a major role as it allows us using electronic circuits,sensors, and programming to detect and control other devices ,it basically connects outside world with computers.The Internet of Things has seen a big boom in development of smart homes and now it is discovering other real world problems to get it done with ease.The information collected through sensors and electronic circuits is stored in central cloud data storage .This stored information can be used for further analysis and data mining tasks.Information can also be made available to the end-user for daily updates on crop production and energy consumption and other related issues.

### RELATED TECHNOLOGIES:

A)**IoT SENSORS:** Sensors are used to collect important information including microclimate data in the greenhouse,control action ,crop growth rate,characteristics of of the crops and more related data.These sensors make the critical information achievable by its sensing technology.In this model there are majorly four types of sensors as follows:

1. **TEMPERATURE SENSORS:** These sensors are used to measure the temperature inside the greenhouse
2. **HUMIDITY SENSORS:** It is used for sensing the vapours in the air models used for thissensing technology are LPPYRA 02[4],E+E ElektronikEE160[18]
3. **CO2 Sensors:**CO2 sensors are available inside the greenhouse for measuring the level of CO2
4. **Sun density Sensors:** Sensors for sensing density of sun rays is a kind of technology used inside the greenhouse.

B)**ENERGY EFFICIENCY:** Energy efficiency is considered as a major need of any major project in the field of Internet of things.Internet of things introduces us to the system of wired and wireless parts to optimize the energy efficiency(EE) performance of 5G(fifth generation).For wired and wireless technology CPZ(Cellular

portioning technology) was utilized. The integration of this both technologies helped us to bring towards a comprehensive solution for energy efficiency in greenhouse.

c) **BIG DATA:** In today's world where every little information is stored on internet and files in the form of text, images, video, audio we also need management of this data in a particular fashion. Now all this data is captured at various Global Positioning system (GPS) points. Graph databases are found on graph theory and can be defined as a form of data store representation that adopts graph structure in expressing data entities properties and semantic queries. Main characteristics of distributed system is the demand to distribute data storage across different locations or network nodes. Each part of the overall system is responsible for generating storing and manipulating various kinds of independent data. Graph representation is an effective way to represent distributed data.

D) **SECURITY:** The basic concept of blockchain mechanism along with encryption algorithm plays an important role for the security of the IoT based green house system strengthening all its security

**E) PRINCIPAL OF MODEL TRANSFORMATION:**

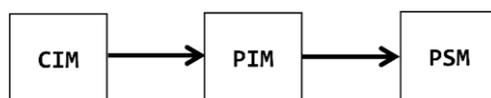


FIGURE 1. Steps of transformation.

There are basically three styles of core models in MDA based totally approaches significantly, CIM (Computation Independent model), PIM (Platform Independent Model) and PSM (Platform Specific Model). The CIM contains all crucial details relating to the matter mentioned by business analyst or domain consultants with none system implementation detail.

The PIM model describes the structure and so the behavior of a system abstractly while not containing concrete technical detail relating to the last word system

The PSM Model describes the structure and behavior of the target system for a selected surroundings and technology.

**II. SYSTEM DESIGN AND ARCHITECTURE:**

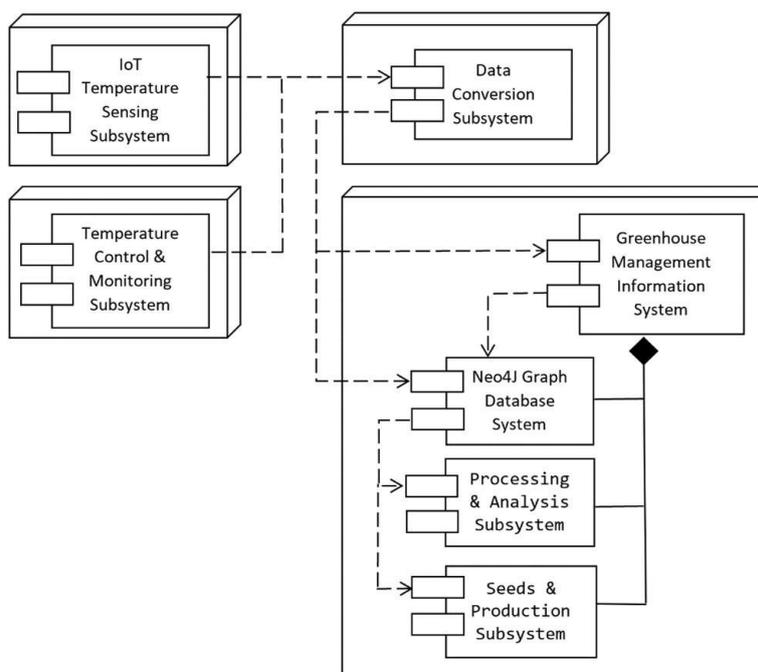


FIGURE 3. Control system scheme.

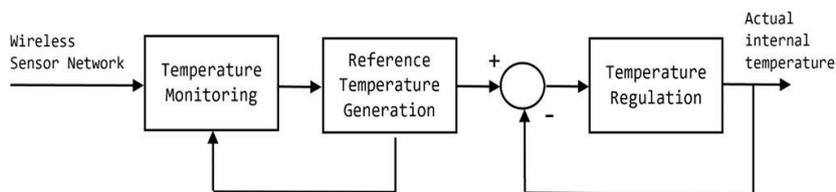


FIGURE 3. Control system scheme

The main motive of greenhouse is to maintain a suitable reference temperature inside the green house which increases the productivity of the crops a slight neglect can damage the crops in the matter of hours. Controllers are considered as a heart of the system where the sensors and actuators build an automated system.

A PETRI NETS Model is used to control the smart spread of awnings according to the angle of sunrays.

This operation is mainly performed in three stages:

The First stage is designed to monitor the external temperature during the rush hours and also check the energy consumption. As soon as there is a rise or fall in temperature the first stage should inform the next stage for the necessary operations to take place.

The Second stage based on the information obtained by first stage the necessary reference signals are generated by the second stage in order to maintain the ideal temperature in the greenhouse.

The Third stage based on the reference signal obtained by second stage regulates the temperature inside the greenhouse it is basically used for monitoring and regulating the temperature.

Thus the PETRI NETS model is basically responsible for listening to outside world creating reference signals and regulating the temperature.

**LIGHTING AWNINGS:**

In the desert areas like KSA(Kingdom of Saudi Arabia)the temperature can exceed upto 50°C in summer that too for large period of day.Hence to cater this problem we can make changes in the scheme of controlled awnings that are thick and soft enough to reduce the effect of sun rays.The awnings open and close automatically according to the angle of Sun rays.As the Sun heads upwards more the awnings open-up more wide upto the sun is exactly perpendicular to the awning when it opens up completely.

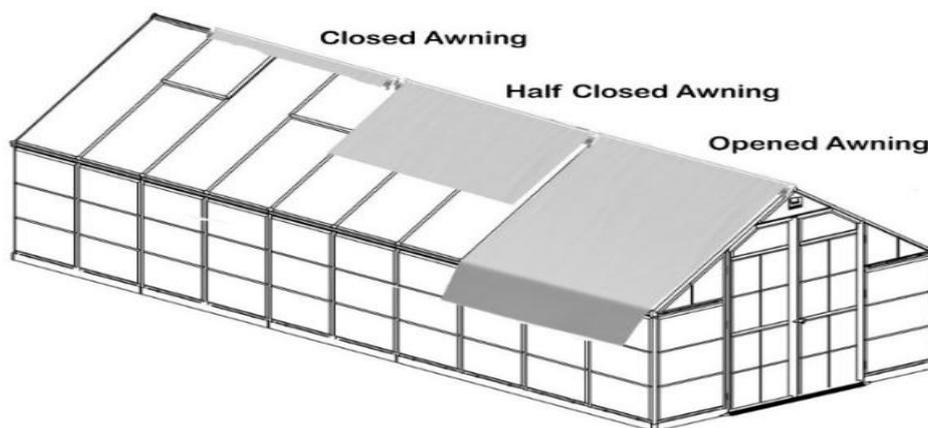


FIGURE 4. Greenhouse awnings.

		TRANSITIONS	
P1	Sun rays angles < 55 or > 150	t1	Sun rays < 55 or > 150 changes detection
P2	55 < Sunrays < 150	t2	55 < Sun rays < 150 changes detection
P3	Standby mode	t3	Working status changes from On to Standby

P4	On mode	t4	Working status changes from Standby to ON
P5	Partially open awnings	t5	Sun rays < 75 or > 130 changes detection
P6	Completely open awnings	t6	75 < Sun rays < 130 changes detection
P7	Intermediary placed	t7	-

**TABLE 1** Proposed PN places and transitions

### III. CONCLUSION

In order to overcome extreme climatic conditions in the KSA, a highly scalable intelligent system that monitors the greenhouse environment, generates reference temperature and regulates internal temperature was developed. This was possible by using integration of various technologies such as Petri-Nets model, Model Driven architectures, adjustment of awnings according to the angle of Sun rays.

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