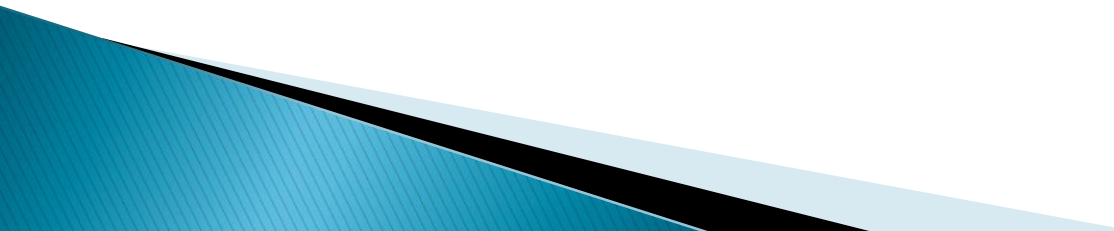



INTELLIGENT GREENHOUSE




INTRODUCTION

- A greenhouse is a controlled–area–environment for the growth of plants.
 - ▶ It is a structural building with different types of covering materials such as glass or plastic.
 - ▶ It heats up because the transparent glass traps the incoming solar radiation , and is absorbed by the plants inside.
 - ▶ They can be used to grow plants under controlled climatic conditions for optimal production.
 - ▶ 'Intelligent Greenhouse' is an arduino–based project wherein we will automate its working to a great extent, in order to reduce manual labor.
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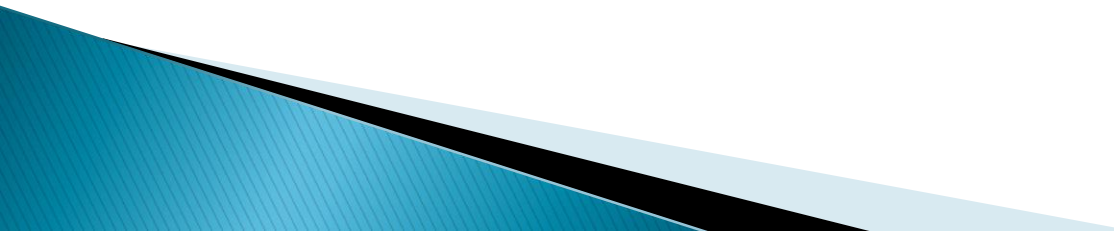
AUTOMATED GREENHOUSE

- ▶ Automated greenhouse involves the automatic monitoring and controlling of climatic parameters which directly or indirectly govern the plant growth and hence their production.
 - ▶ In order to control the climate factors and environment autonomously , it requires a computer/software equipment.
 - ▶ The motivation for this project came from automation in an agricultural field, for people who are lacking technologically. Instead of a field, we tried to implement it in a greenhouse so that it could be easily demonstrated.
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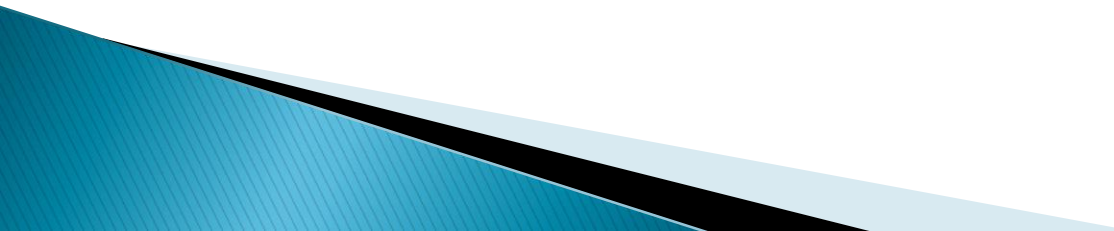
OBJECTIVES

- ▶ To build a miniature green house equipped with automatic monitoring and controlling system.
 - ▶ Constantly monitor and control environmental conditions in greenhouse to ensure that it remains at favorable temperature, light, moisture and humidity levels.
 - ▶ The user can see the atmospheric conditions of the greenhouse plants on website and control the greenhouse from far away places.
- 

WORK PLAN

- Phase I : Research and literature survey.
 - Phase II : Studying, designing and developing of sensors/components.
 - Phase III : Modeling of green house structure.
 - Phase IV : Connecting to Ethernet or App.
- 

INDIAN AGRICULTURAL RESEARCH INSTITUTE, PHYTOTRON FACILITY

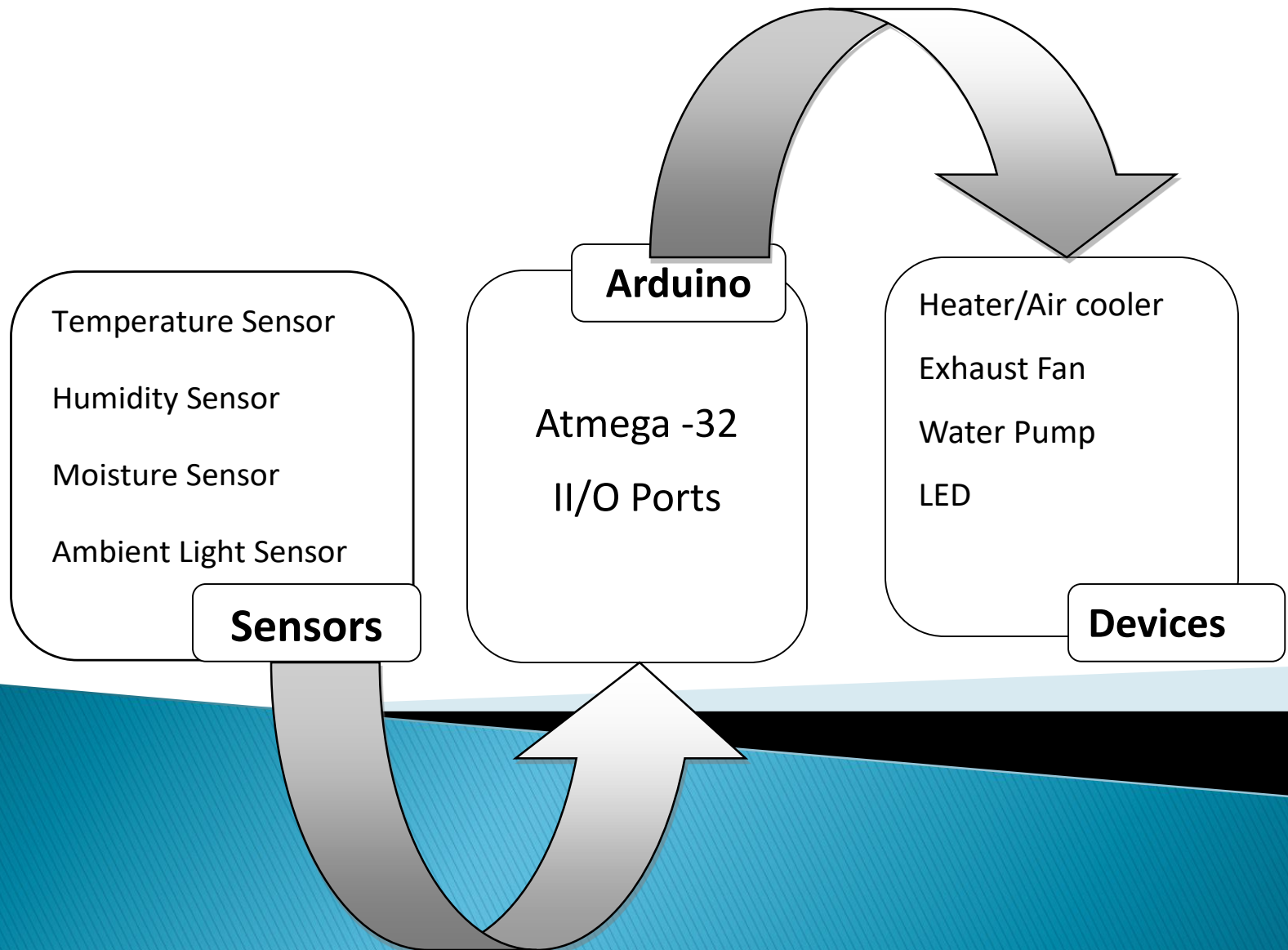
- ▶ A **phytotron** is an enclosed research greenhouse used for studying interactions between plants and the environment. The Institute established a National Phytotron Facility in 1997. This is the first facility of its kind in the country to study the live responses of plants under controlled conditions and the possible impact of climate change and greenhouse gases. It has a self-contained area of 2700 m², housing 22 growth chambers and 10 greenhouses. The facility is made available for plant scientists belonging to ICAR, CSIR, SAUs, traditional universities and agro-industries to understand the complicated interaction of physiochemical environments and living systems, especially the plants and their pathogens.
- 




FEATURES

- Detect and maintain temperature from -55°C to 150°C .
- Detect and maintain moisture in soil
- Detect sunlight and artificial light.
- Detect and maintain humidity level.

SYSTEM OVERVIEW



COMPONENTS

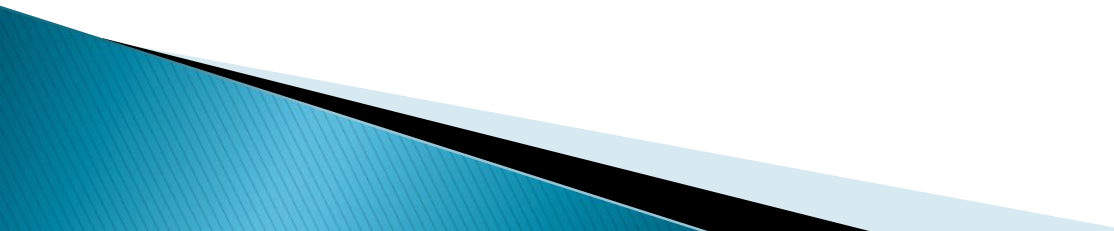
- ▶ Arduino Uno
 - ▶ LM35 Temperature Sensor
 - ▶ SOIL MOISTURE SENSOR(YL-69) /
HYGROMETER
 - ▶ LDR(Light Dependent Resistor)
 - ▶ HUMIDITY SENSOR (dht 22)
 - ▶ Mini Cooler
 - ▶ Heater
 - ▶ Sprinklers and Water tank
 - ▶ LED strips
 - ▶ Exhaust Fan
- 

ARDUINO IN THE GREENHOUSE

- Arduino is the heart of intelligent green house
- Arduino boards are able to receive, analyze and send data in order to maximize plant growth and health

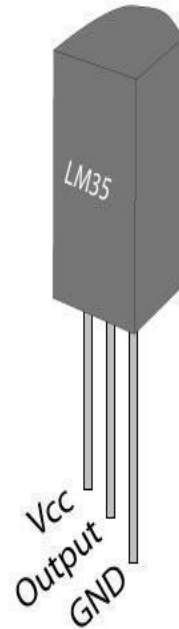


Advantages of Arduino

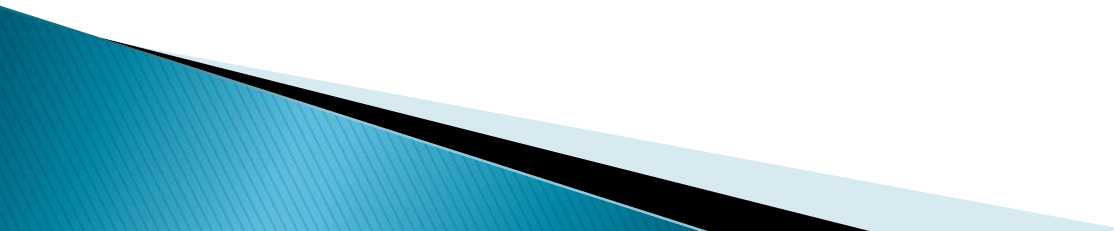
- Huge documentation and support
 - Larger library collection
 - Open source
 - Simplified and user-friendly programming language
 - No additional programmer/burner hardware required for programming board
 - Highly Portable
 - Low power consumption
 - Highly customizable
- 

TEMPERATURE SENSOR (LM-35)

- ▶ The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device does not require any external calibration or trimming to provide accuracies of $\pm 1/4^{\circ}\text{C}$ at room temperature.

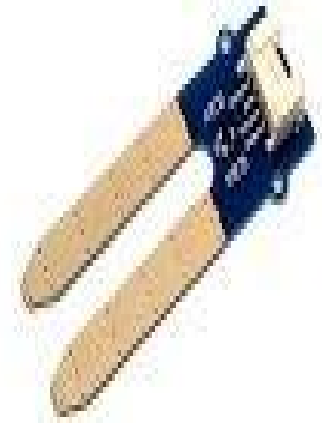


FEATURES OF LM35

- ▶ The operating temperature range is from -55°C to 150°C .
 - ▶ Linear + $10\text{-mV}/^{\circ}\text{C}$ Scale Factor
 - ▶ Operates from 4 V to 30 V
 - ▶ Less than $60\text{-}\mu\text{A}$ Current Drain
 - ▶ Low Self-Heating, 0.08°C in Still Air
 - ▶ Non-Linearity Only $\pm 1/4^{\circ}\text{C}$
- 

SOIL MOISTURE SENSOR (YL-69)

- ▶ This is an Electrical resistance Sensor. The sensor is made up of two electrodes. This soil moisture sensor reads the moisture content around it. A current is passed across the electrodes through the soil and the resistance to the current in the soil determines the soil moisture. If the soil has more water resistance will be low and thus more current will pass through. On the other hand when the soil moisture is low the sensor module outputs a high level of resistance.



LIGHT DEPENDENT RESISTOR (LDR) / PHOTORESIST

- ▶ A photoresistor is a light controlled variable resistor. It follows the principle of photoconductivity i.e. resistance of photoresistor decreases with increasing light intensity.



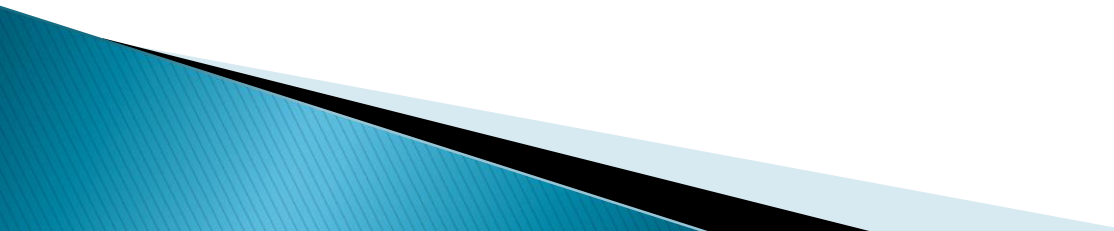
- ▶ A photoresistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as several mega ohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance.

HUMIDITY SENSOR (DHT22)

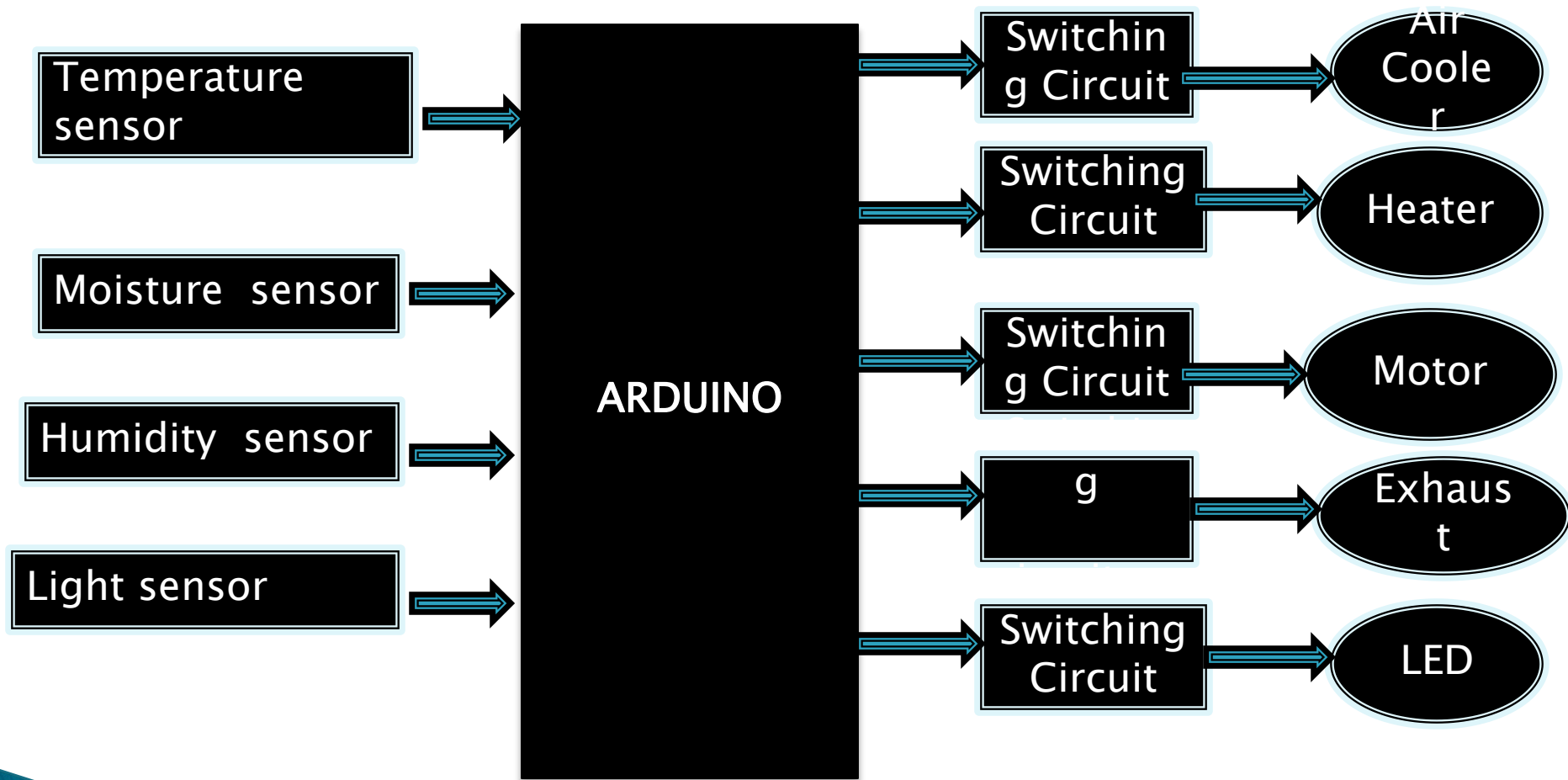
- ▶ DHT22 output calibrated digital signal. It utilizes exclusive digital-signal-collecting-technique and humidity sensing technology, assuring its reliability and stability.
- ▶ Small size & low consumption & long transmission distance (20m) enable AM2303 to be suited in all kinds of harsh application occasions.
- ▶ Single-row packaged with four pins, making the connection very convenient.



OUTPUT DEVICES

- ▶ **Air Cooler** to decrease the greenhouse temperature
 - ▶ **Heater** for increasing the temperature
 - ▶ **Exhaust Fan** to reduce the humidity inside the greenhouse.
 - ▶ **Water Pump** to increase the soil moisture.
 - ▶ **LED strips** light in order to provide sufficient light to the plants.
- 

BLOCK DIAGRAM

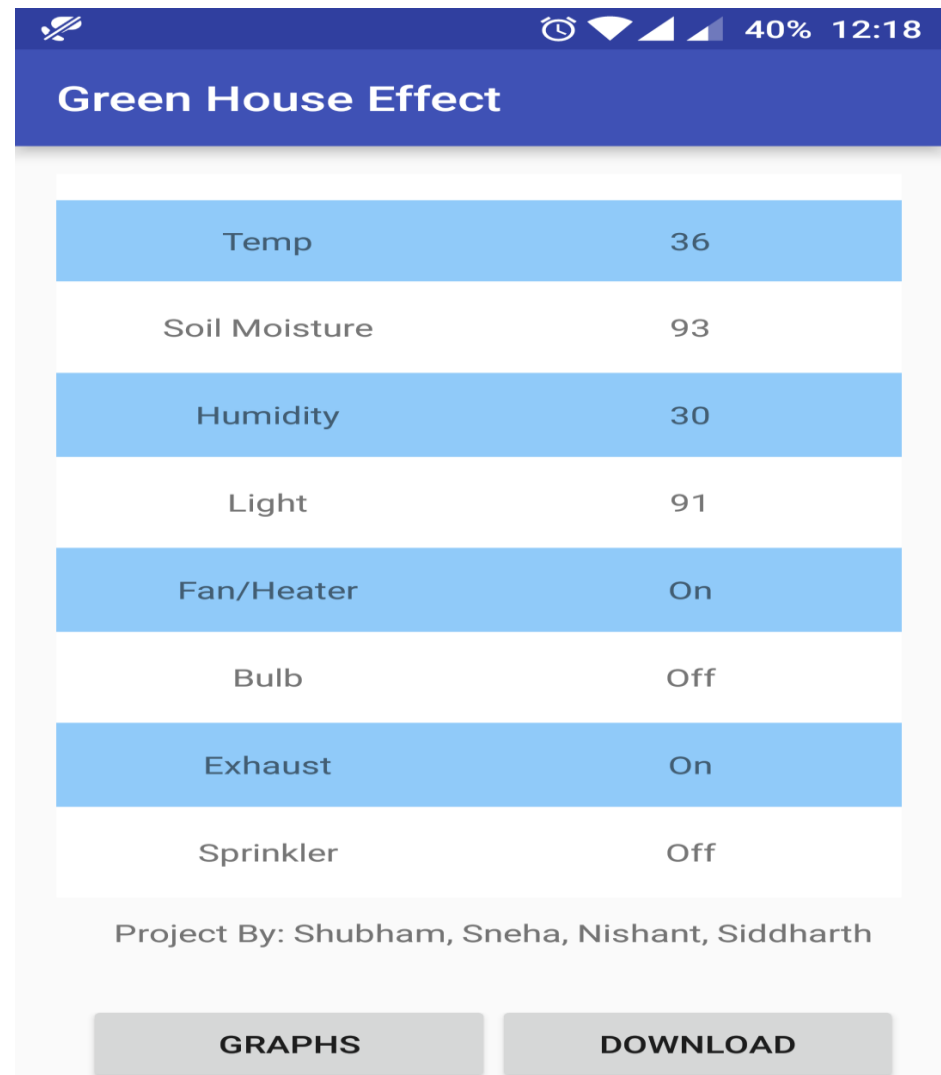


FUNCTIONS

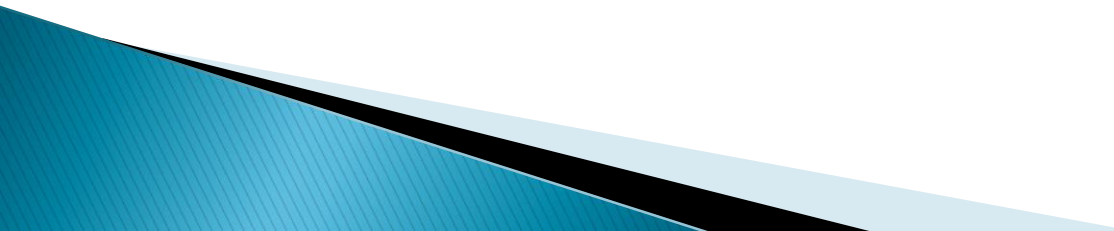
- **Lowering Temperature:** Cooling Device(Air Cooler used for demonstration)
- **Raise Temperature:** Heater(indicated by heater dryer for demonstration)
- **Decrease Humidity :** Exhaust Fan
- **Increase Moisture Level:** Water pump connected to water tank
- **Increasing Lighting Condition :** LED Strips

MONITORING THROUGH MOBILE APPLICATION

- ▶ A wifi module(ESP 8266) is connected to arduino which connects the greenhouse to application .
- ▶ Mobile application monitors the sensor values and also provide graphical images via think speak server.



THINKSPEAK SERVER

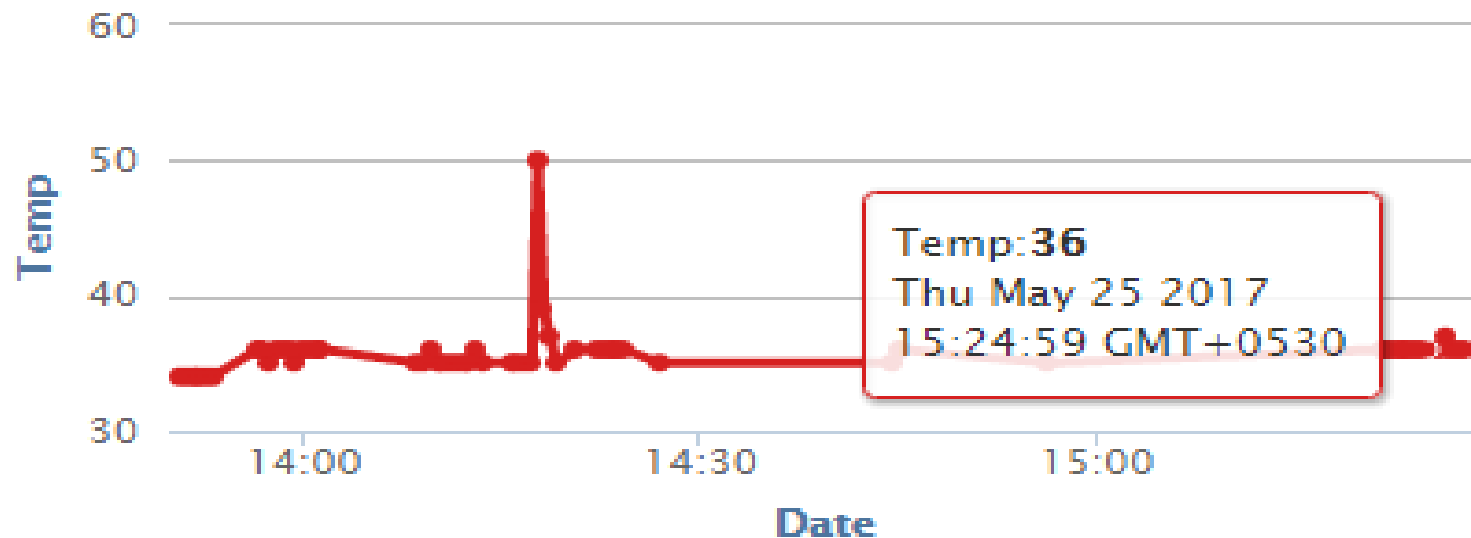
- ▶ ThingSpeak is an open source Internet of Things application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network.
 - ▶ Provides numerical as well as graphical values with respect to date/time
- 

TEMPERATURE MONITORING

Field 1 Chart



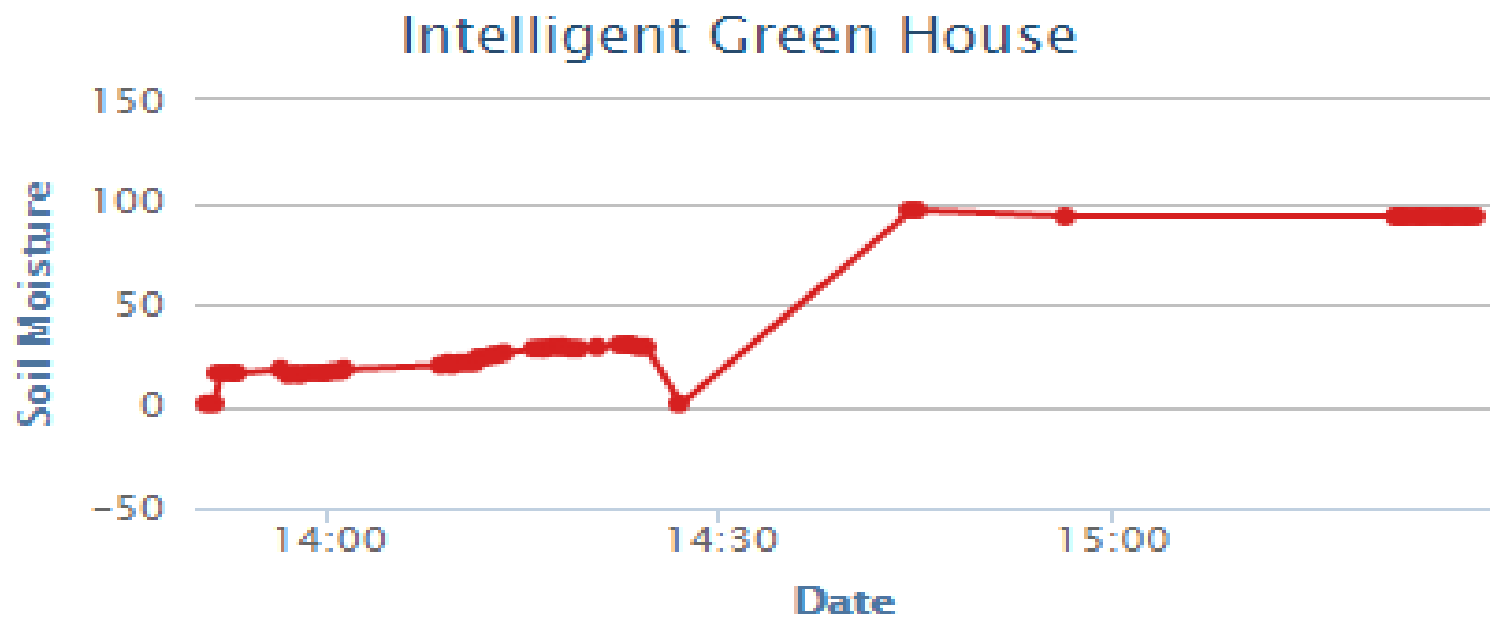
Intelligent Green House



ThingSpeak.com

SOIL MOISTURE MONITORING

Field 2 Chart



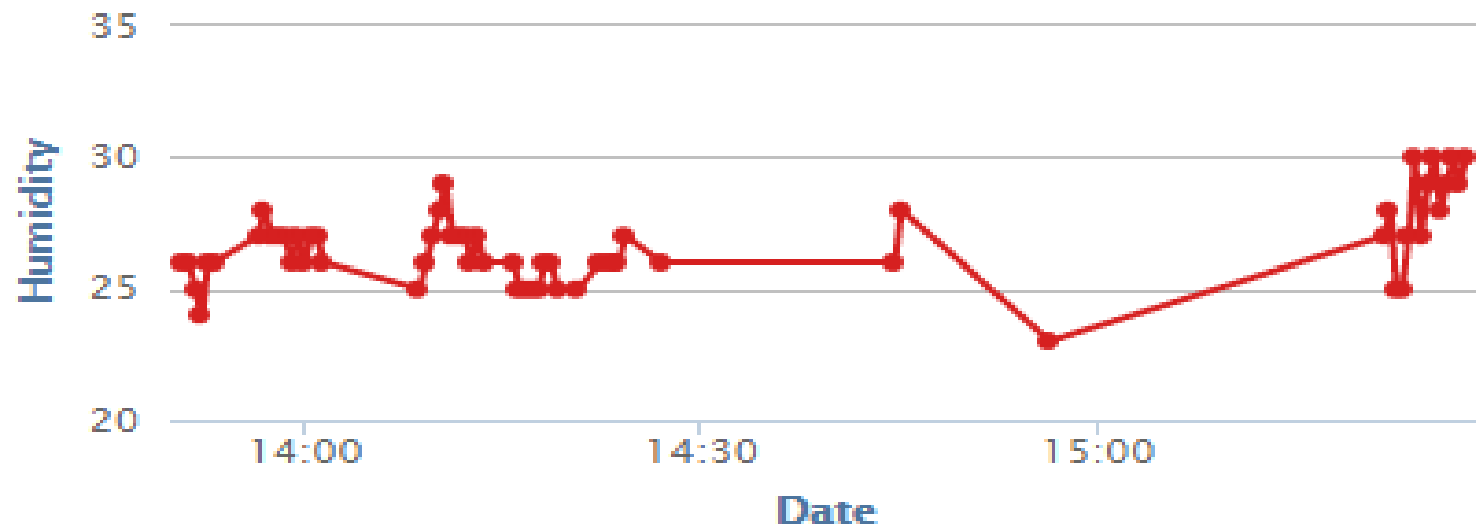
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HUMIDITY MONITORING

Field 3 Chart



Intelligent Green House



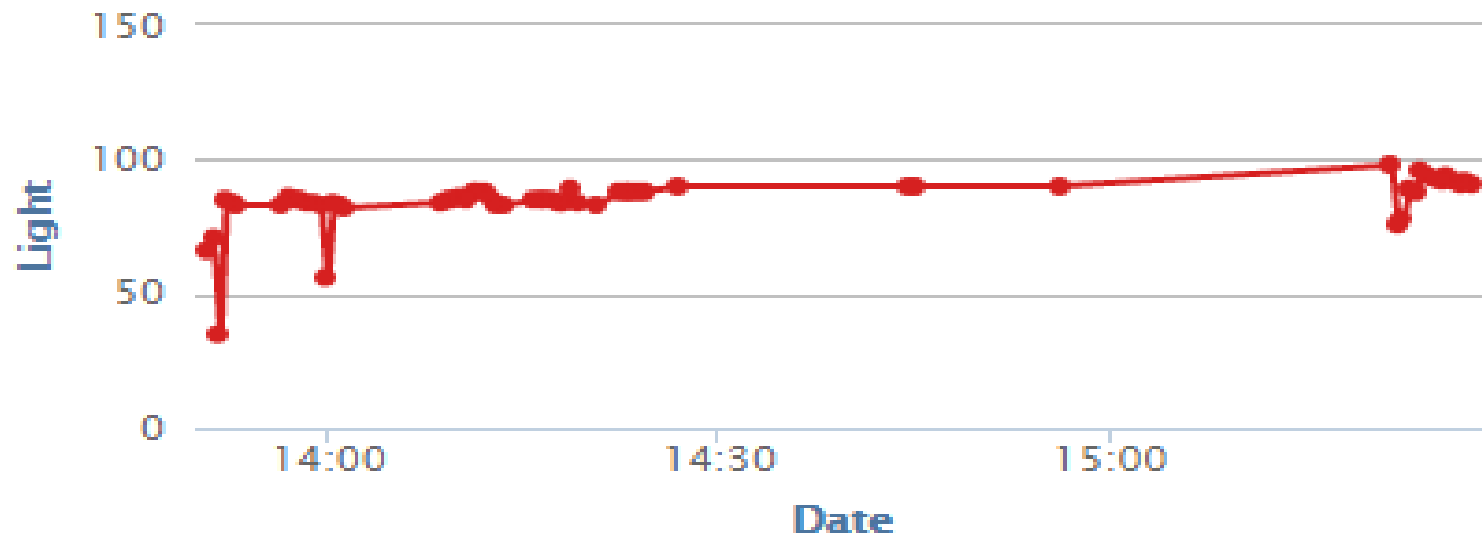
ThingSpeak.com

LIGHT MONITORING

Field 4 Chart



Intelligent Green House

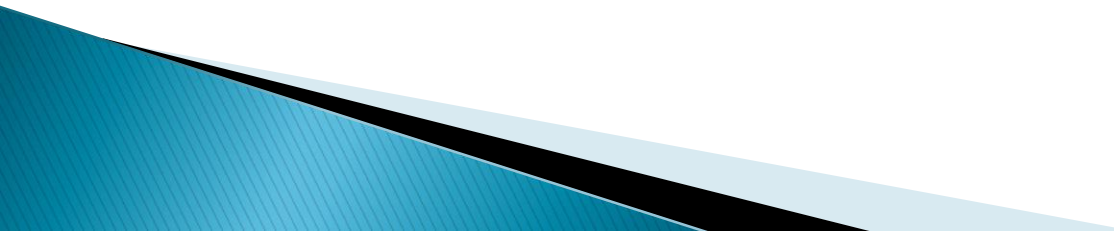


ThingSpeak.com

ADVANTAGES OF Intelligent Greenhouse

- ▶ Automatically control environmental conditions within greenhouse allowing any type of plants to be grown all year round
- ▶ Eliminates risk of greenhouse not being maintained at specific environmental conditions due to human error.
- ▶ Helpful to those who are technologically backward, as it reduces human dependency.
- ▶ Minimizes labor costs involved in maintaining a greenhouse
- ▶ Customer able to define specific greenhouse conditions
- ▶ “Plug-and play” product

FURTHER EXTENSIONS

- ▶ The project can be extended on a large scale to be implemented in an actual agricultural field.
 - ▶ It will prove helpful to those who are technologically backward, as it reduces human dependency.
 - ▶ The project can be extended on large scale by growing multiple crop/flower in single intelligent greenhouse with different chambers.
 - ▶ For further advancement this could be done using cloud computing
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THANK YOU