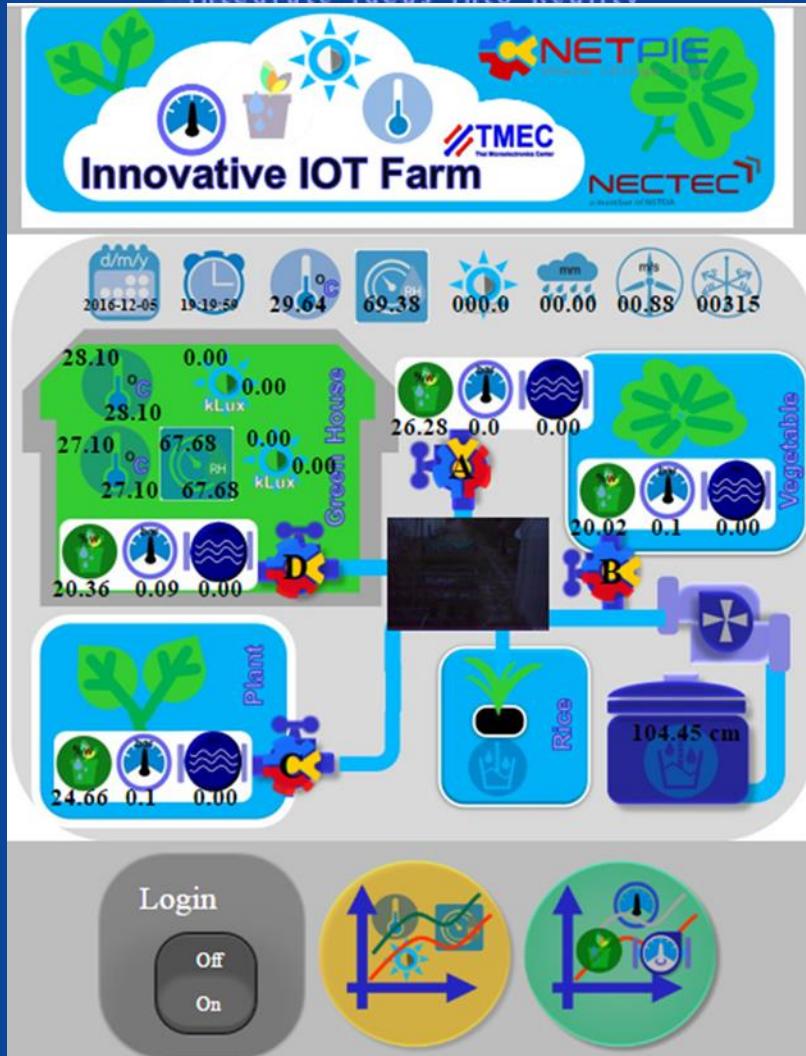




Thai Microelectronics Center
Integrate Ideas Into Reality



WiMaRC System

Wireless Sensor Network for
Management and
remote
Control

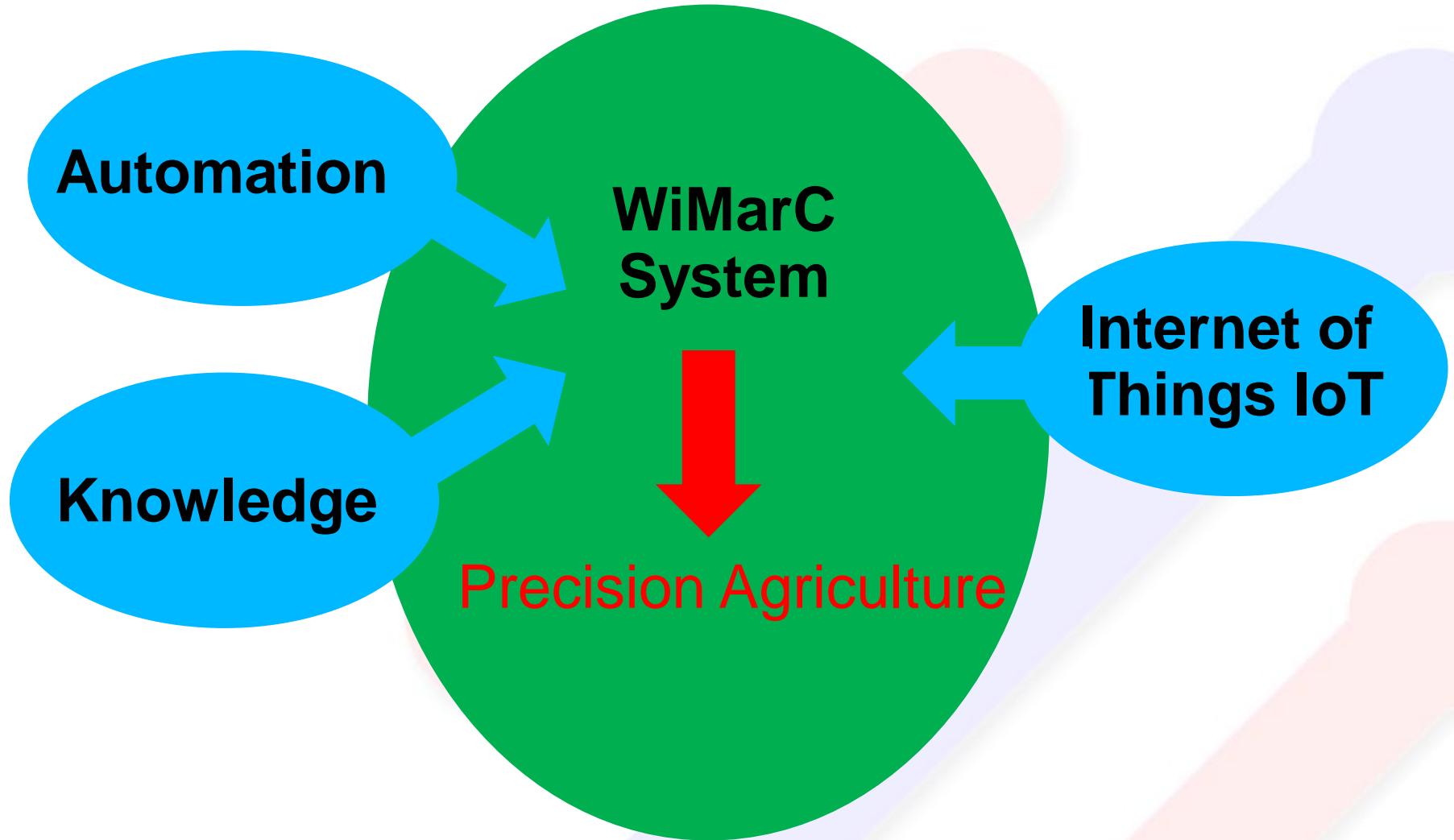
Opas Trithaveesak

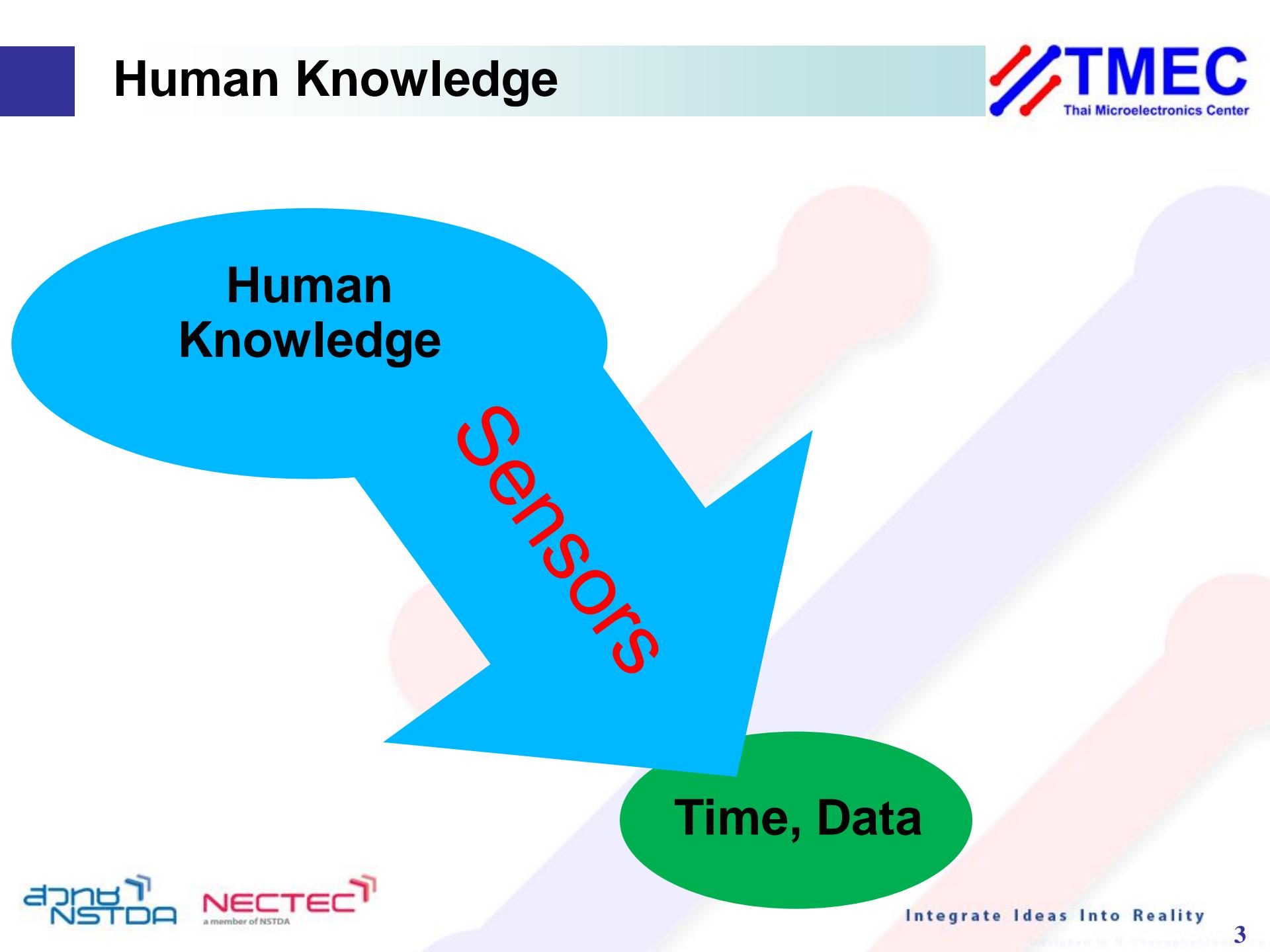
<http://tmeconnect.nectec.or.th>
email : opas.trithaveeak@nectec.or.th

NECTEC נאתקה
a member of NSTDA



WiMarC System





Human
Knowledge

Sensors

Time, Data

Sensors for Precision Agriculture

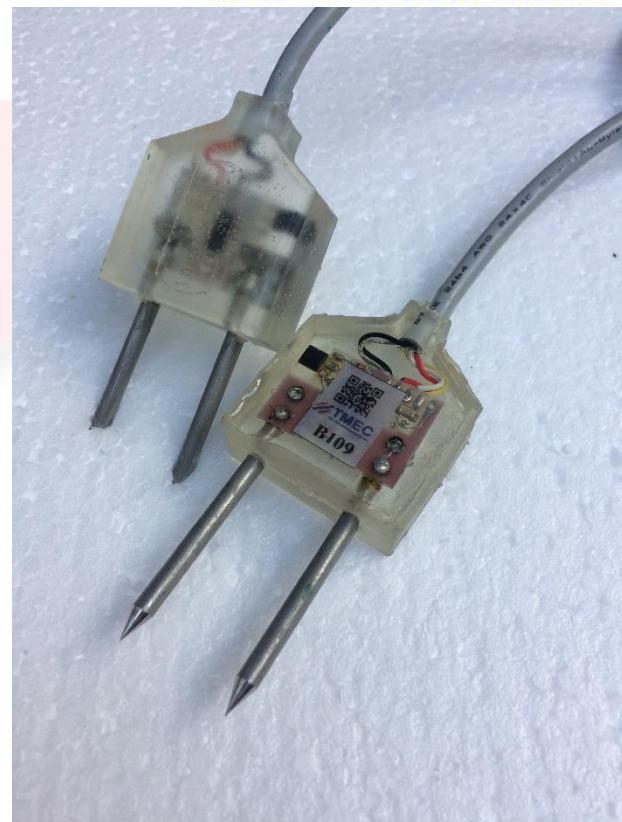


Soil Moisture Sensor
Temperature Sensor
Humidity Sensor
Pressure Sensor
Soil Nutrients Sensor
Flow Sensor
Etc.

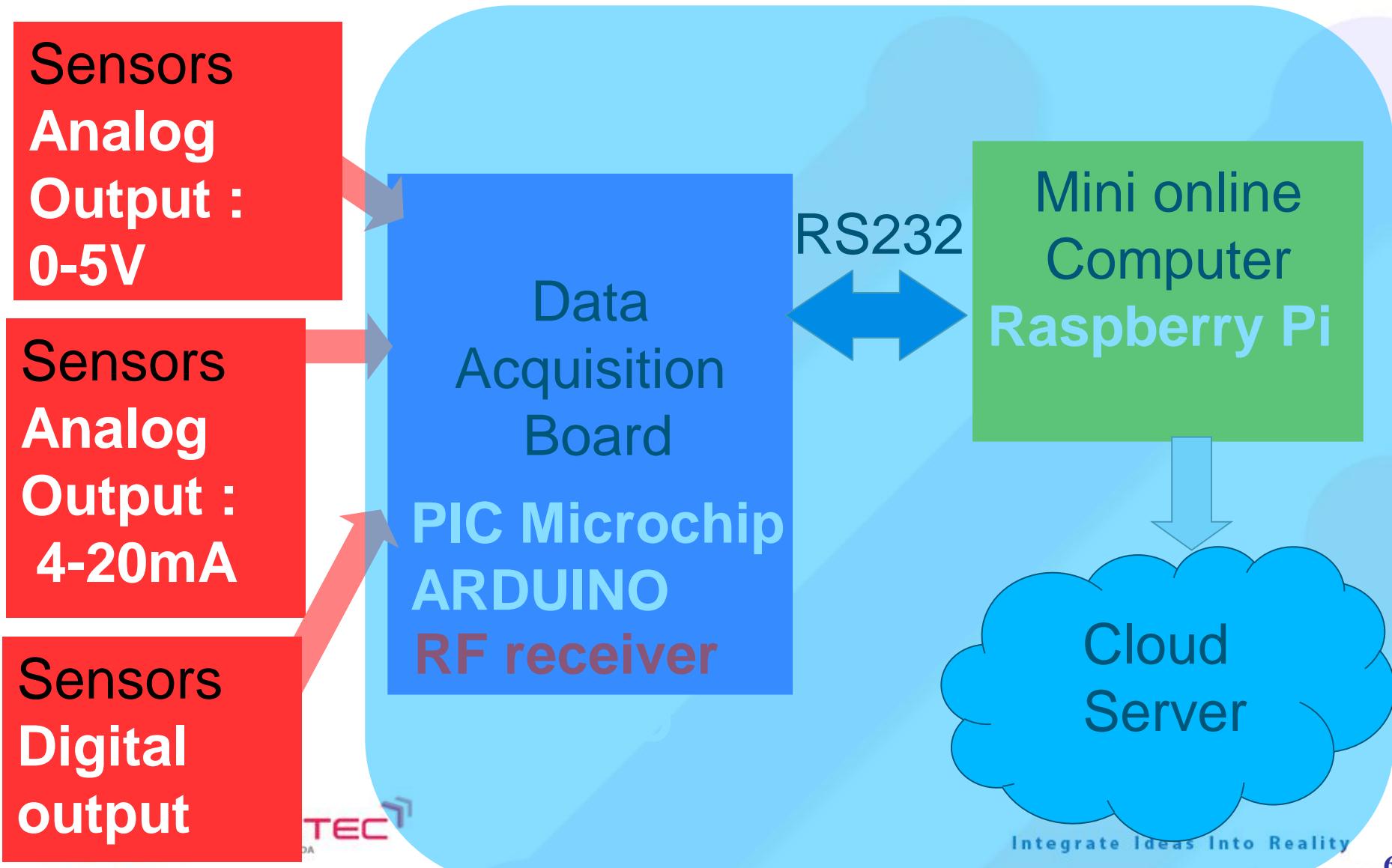
Sensors for Agricultural Research

TMEC's Sensor

- Soil Moisture Sensor
- Light Intensity Sensor
- Pressure Sensor
- pH Sensor
- Nitrate Sensor



Master Sensor Network System



Temp&Humidity Sensor

Datasheet SHT3x-ARP

Humidity and Temperature Sensor IC

- Fully calibrated, linearized, and temperature compensated analog output
- Wide supply voltage range, from 2.4 V to 5.5 V
- 10% to 90% ratiometric analog voltage output
- Typical accuracy of $\pm 2\%$ RH and $\pm 0.3^\circ\text{C}$
- Parallel measurement of temperature and humidity at separate pins
- Tiny 8-Pin DFN package

SENSIRION
THE SENSOR COMPANY



Humidity Sensor Specification

Parameter	Conditions	Value	Units
SHT30 Accuracy tolerance ¹	Typ.	± 3	%RH
	Max.	Figure 2	-
SHT31 Accuracy tolerance ¹	Typ.	± 2	%RH
	Max.	Figure 3	-
Repeatability ²		0.1	%RH
Resolution	Typ.	0.01	%RH
Integrated Non-Linearity ³	Typ.	0.2	%RH
Hysteresis	at 25°C	+0.8	%RH
Specified range ⁴	extended ⁵	0 to 100	%RH
Response time ⁶	$t_{63\%}$	8	s
Long-term drift	Typ. ⁷	<0.25	%RH/yr
	$V_{DD}=2.4\text{ V}$	19.2	mV/%RH
Sensitivity	$V_{DD}=3.3\text{ V}$	26.4	mV/%RH
	$V_{DD}=5.5\text{ V}$	44.0	mV/%RH

Table 1 Humidity sensor specification

Temperature Sensor Specification

Parameter	Condition	Value	Units
SHT30 Accuracy tolerance ¹	Typ., 0°C to 65°C	± 0.3	°C
SHT31 Accuracy tolerance ¹	Typ., -40°C to 90°C	± 0.3	°C
Repeatability ²		0.06	°C
Resolution	Typ.	0.015	°C
Specified Range	-	-40 to 125	°C
Response time ⁶	$t_{63\%}$	>2	s
Long Term Drift	Max.	<0.03	°C/yr
	$V_{DD}=2.4\text{ V}$	11.0	mV/°C
	$V_{DD}=3.3\text{ V}$	15.1	mV/°C
Sensitivity	$V_{DD}=5.5\text{ V}$	25.1	mV/°C

Table 2 Temperature sensor specification

Temp&Humidity Sensor

Datasheet SHT3x-ARP

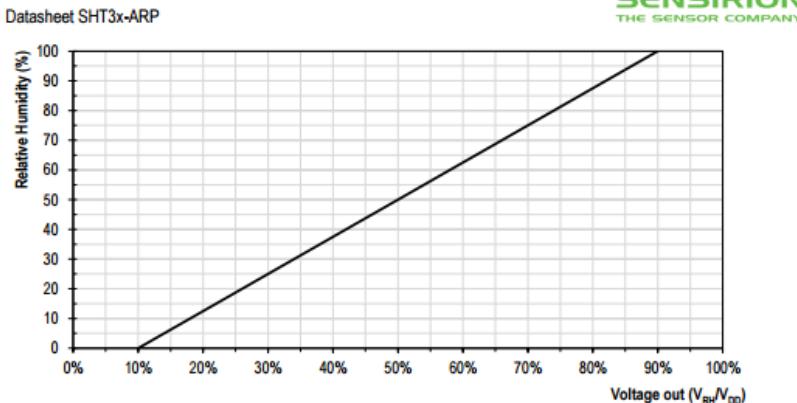


Figure 9 Relationship between the ratiometric analog voltage output and the measured relative humidity.

$$RH = -12.5 + 125 \cdot \frac{V_{RH}}{V_{DD}} = -\frac{10}{0.8} + \frac{100}{0.8} \cdot \frac{V_{RH}}{V_{DD}} \quad (1)$$

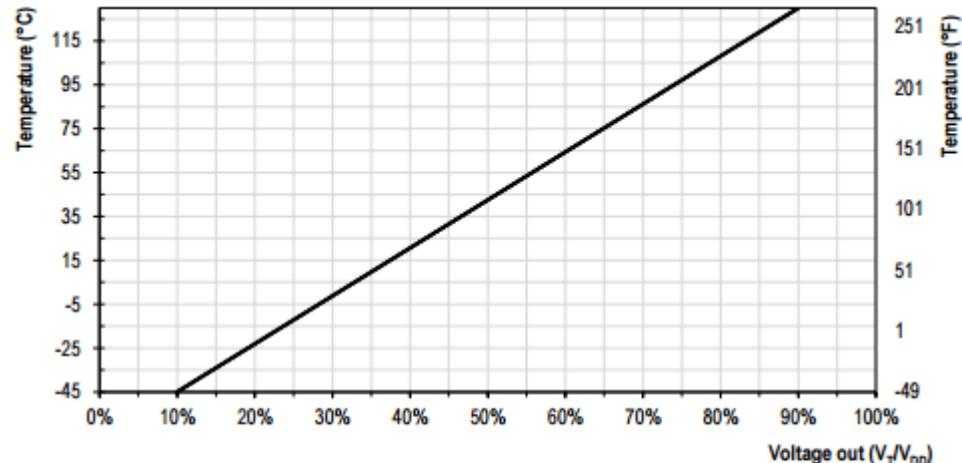


Figure 10 Relationship between the ratiometric analog voltage output and the measured temperature

$$T [^{\circ}\text{C}] = -66.875 + 218.75 \cdot \frac{V_T}{V_{DD}} = -45 - \frac{17.5}{0.8} + \frac{175}{0.8} \cdot \frac{V_T}{V_{DD}} \quad (2)$$

$$T [^{\circ}\text{F}] = -88.375 + 393.75 \cdot \frac{V_T}{V_{DD}} = -49 - \frac{31.5}{0.8} + \frac{315}{0.8} \cdot \frac{V_T}{V_{DD}} \quad (3)$$

Light Intensity Sensor

NECTEC
a member of NSTDA

เซ็นเซอร์วัดความเข้มแสง รุ่น T17-1

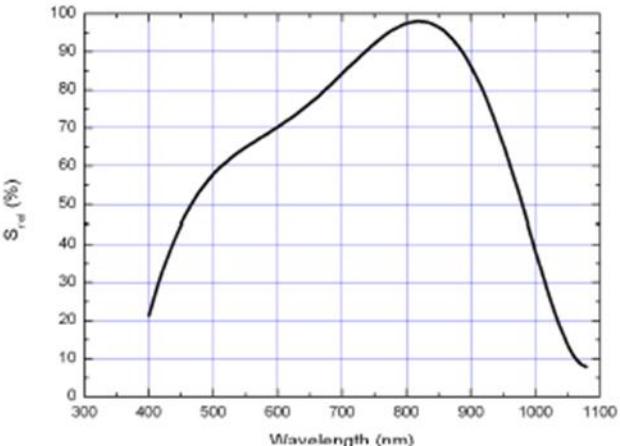


คุณสมบัติทางด้านเทคนิค
ช่วงคลื่นแสงที่ตอบสนอง : 400-1000nm
ช่วงการวัด : 0-1000W/m²
ค่าความถูกต้อง : +/- 5%
ความละเอียด : +/- 5 W/m²
ช่วงอุณหภูมิการใช้งาน : 20-60 C
สัญญาณไฟฟ้าเชิงเส้น : แรงดันไฟฟ้าในช่วง 0 - 4.4V (แรงดันไฟฟ้าต่ำสุด 5 V)

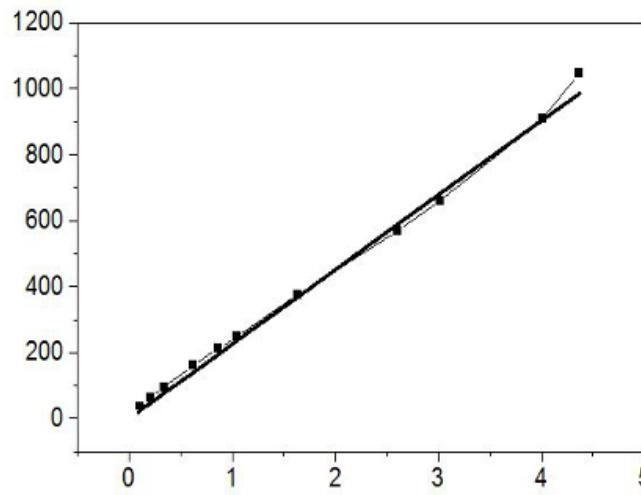
สอบถามเพิ่มเติมการใช้งาน:
ศูนย์เทคโนโลยีโลจิสติกส์
51/4 ม.1 ต.วังตะเคียน อ.เมือง จ.ฉะเชิงเทรา 24000
โทร 038-857100-9

Rel. Spectral Sensitivity

$$S_{\text{rel}} = f(\lambda)$$



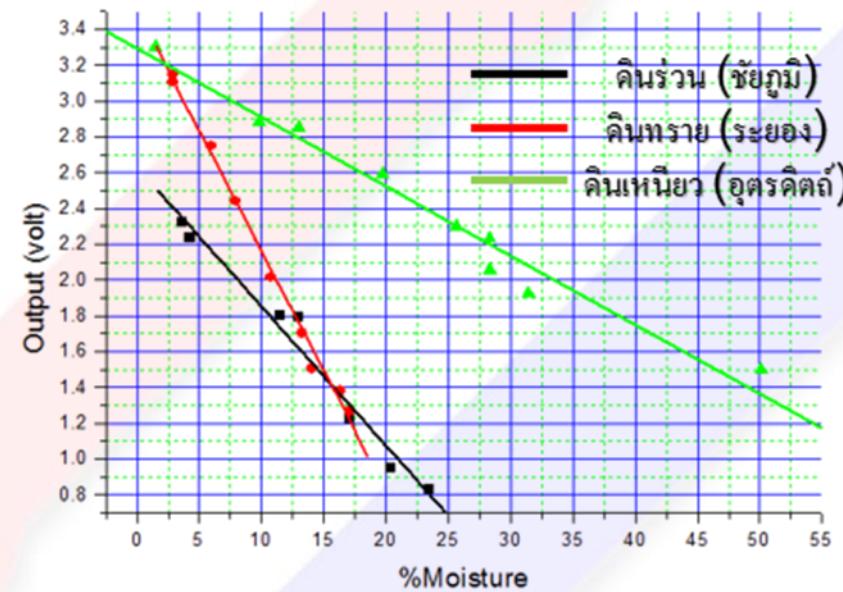
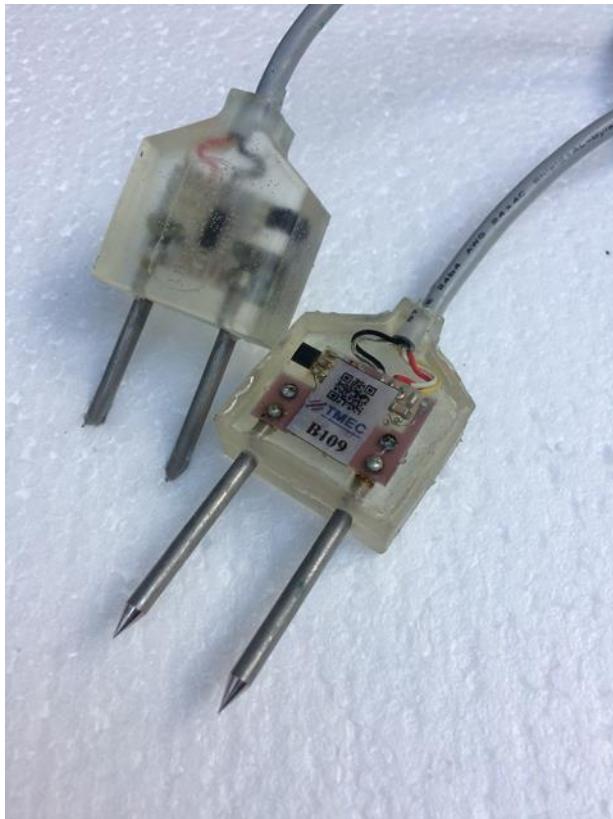
ค่าความเข้มแสง (W/m²)



Pressure Sensors



Soil Moisture Sensor



Conductivity Sensor

- Water quality monitoring
- Aquaculture
- Hydroponic & Aquaponic
- Fertilizer control



Rain Gauge



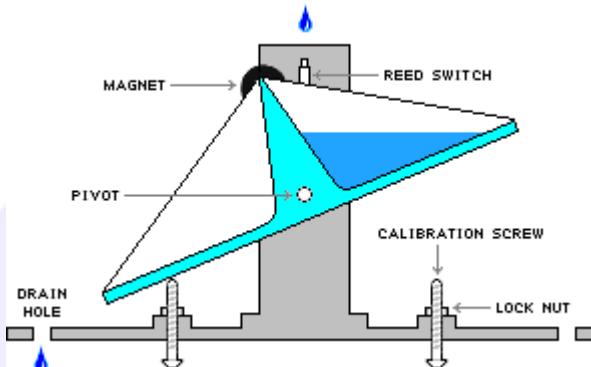
rikasensor.en.alibaba.com



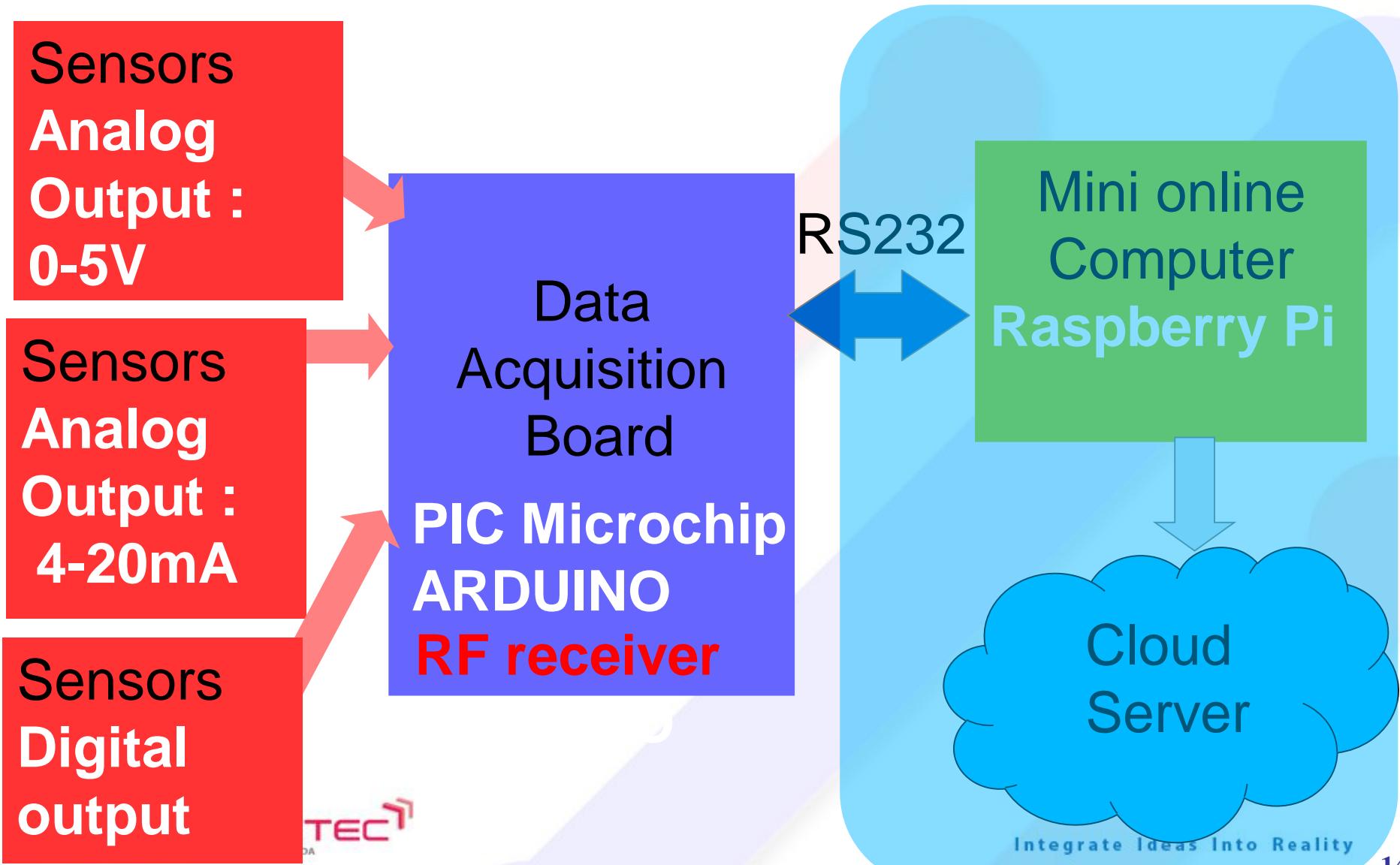
www.rikasensor.com

SPECIFICATION

Item	Specification
Collector	diameter :φ200mm, height: 271mm
Measuring range	≤ 4mm/min
Resolution	0.2mm
Accuracy	±2%
Maximum load voltage	30VDC
Maximum load current:	20mA
Output	5Pulses/mm(@10kΩ&0.01uF)
Operating temperature	-20-80°C
Main material	ABS
Weight(unpacked)	1kg

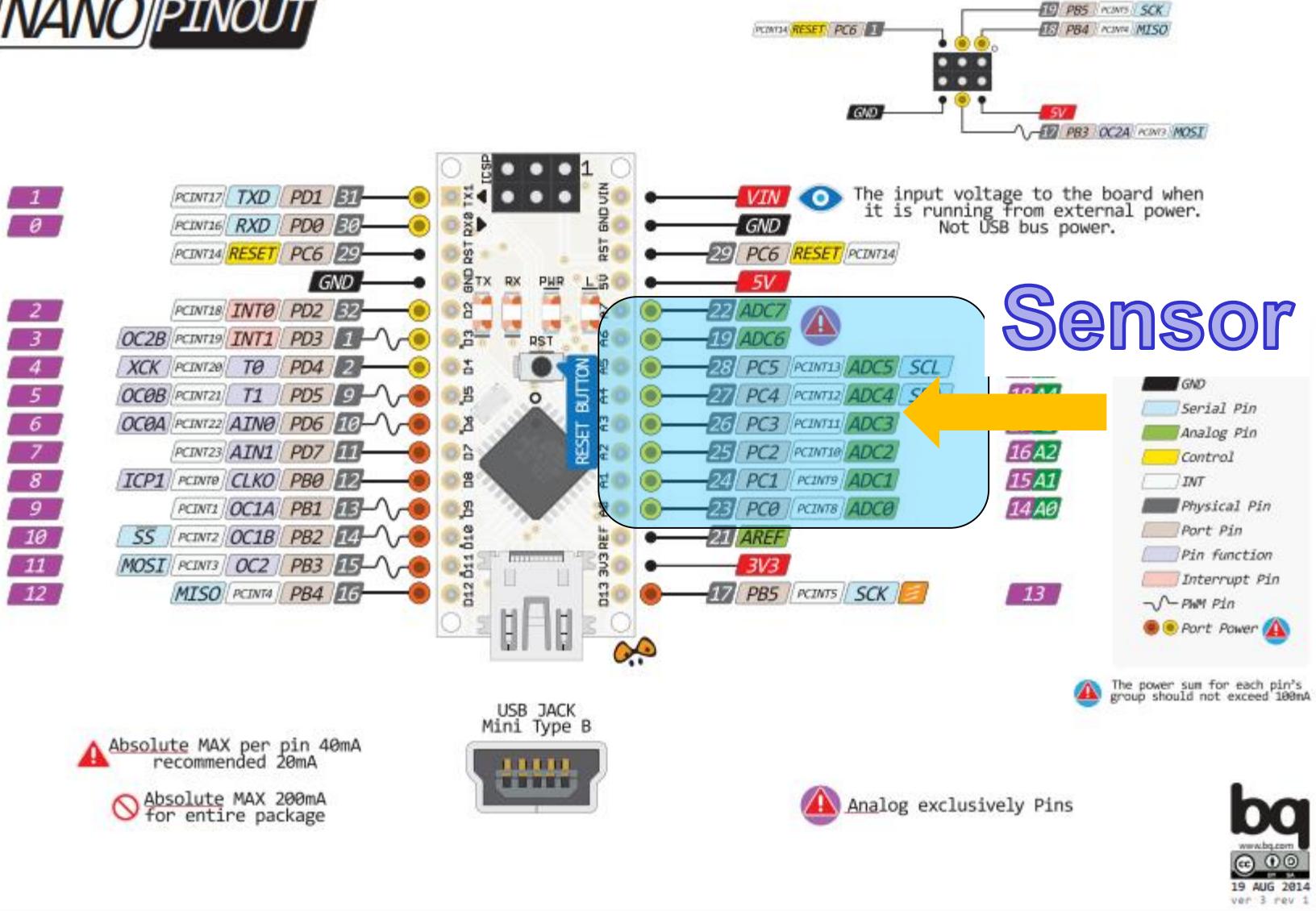


Master Sensor Network System

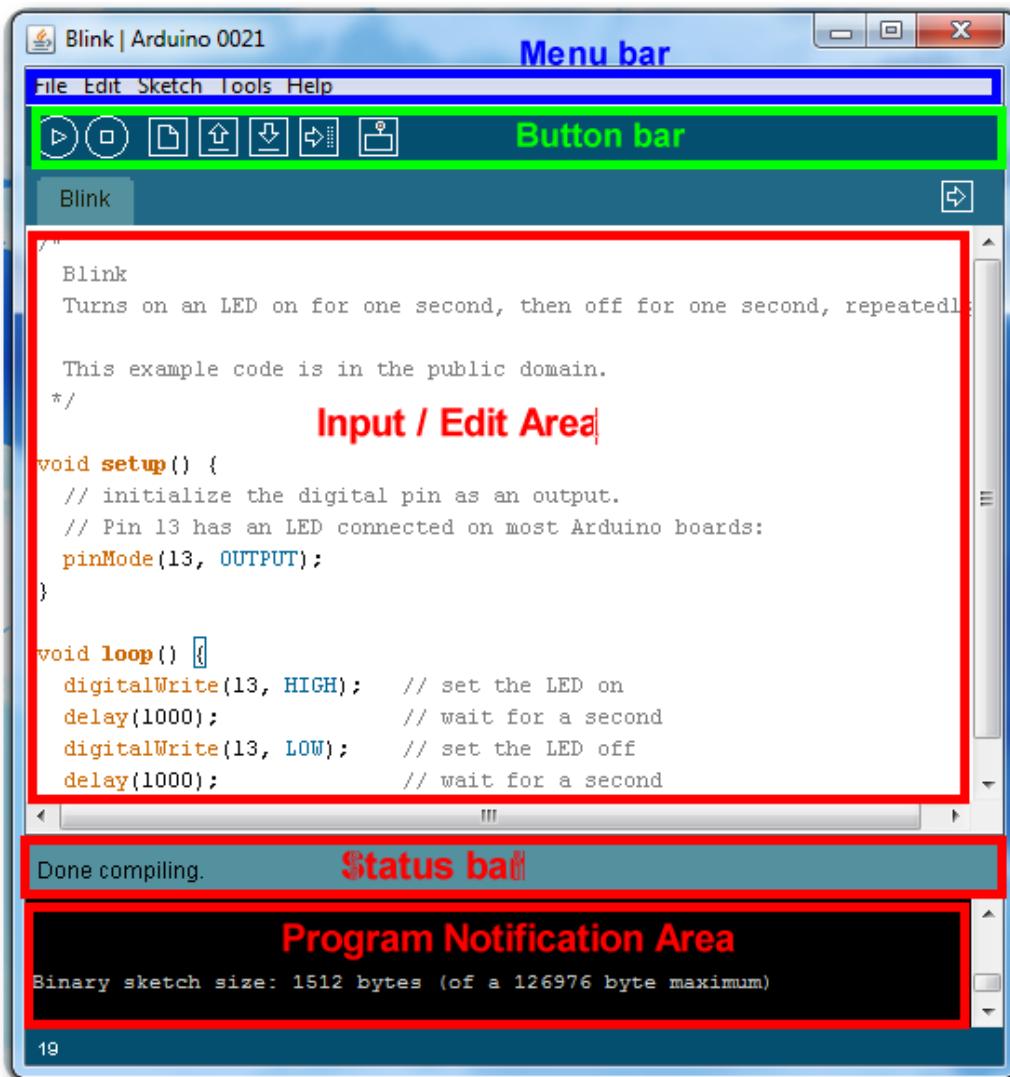


Arduino NANO

NANO PINOUT

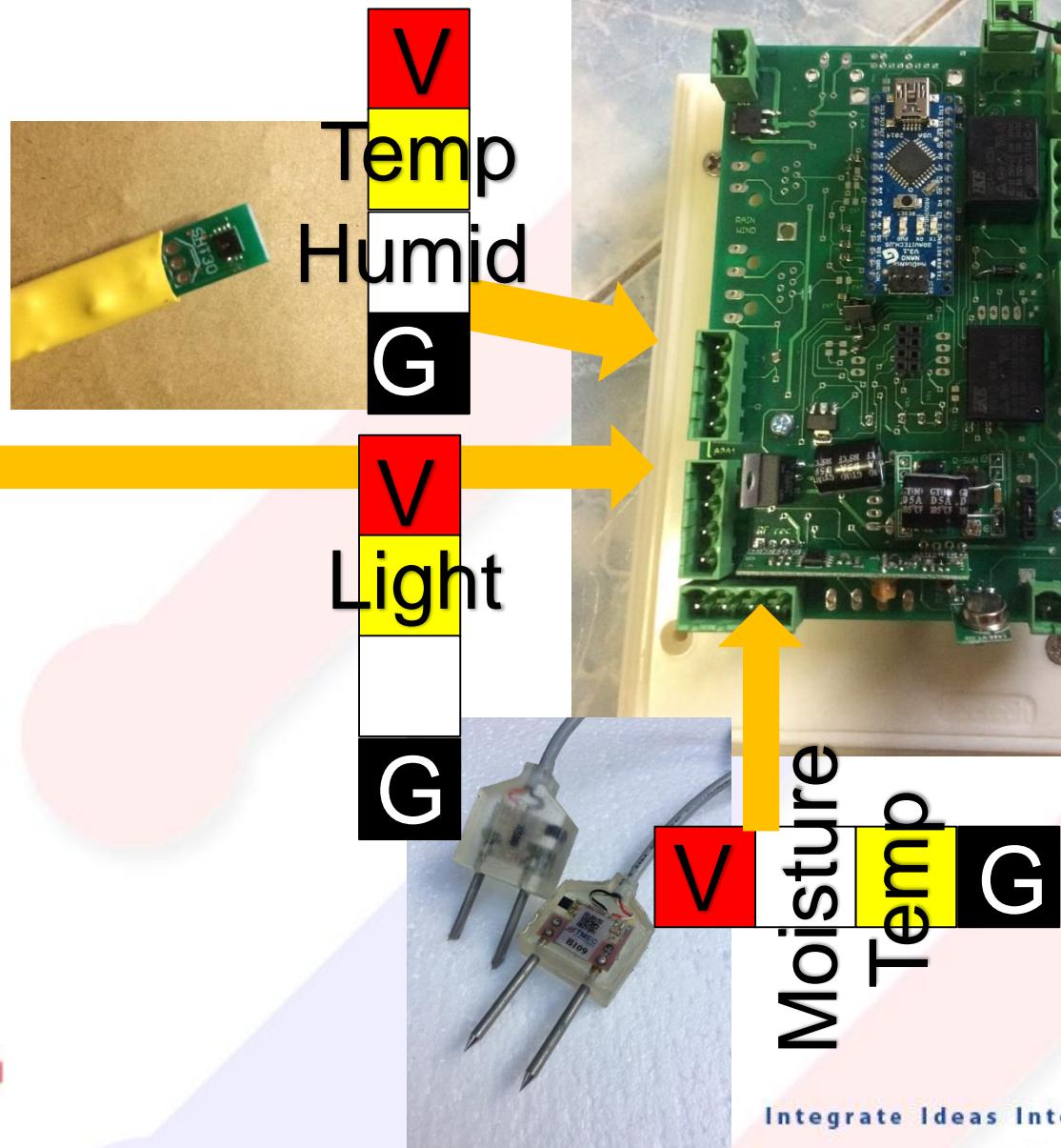


Arduino IDE



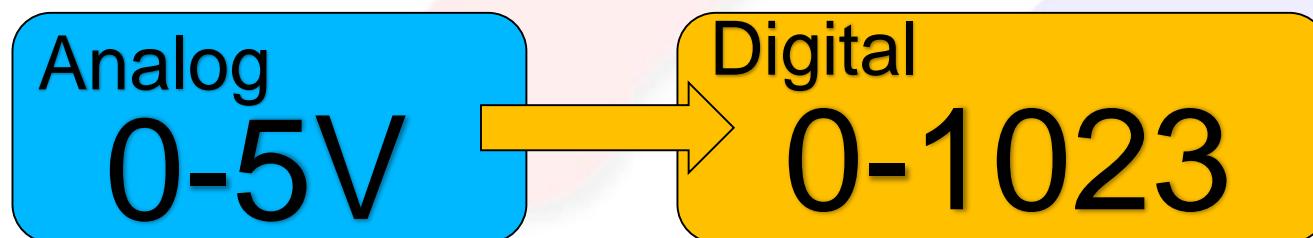
See: <http://arduino.cc/en/Guide/Environment> for more information

Sensors



Analog to Digital

```
vln1 = analogRead(0);  
vln1 = vln1*voltref;  
vln1 = vln1/102.3-voltoffset;
```



Digital to Temp

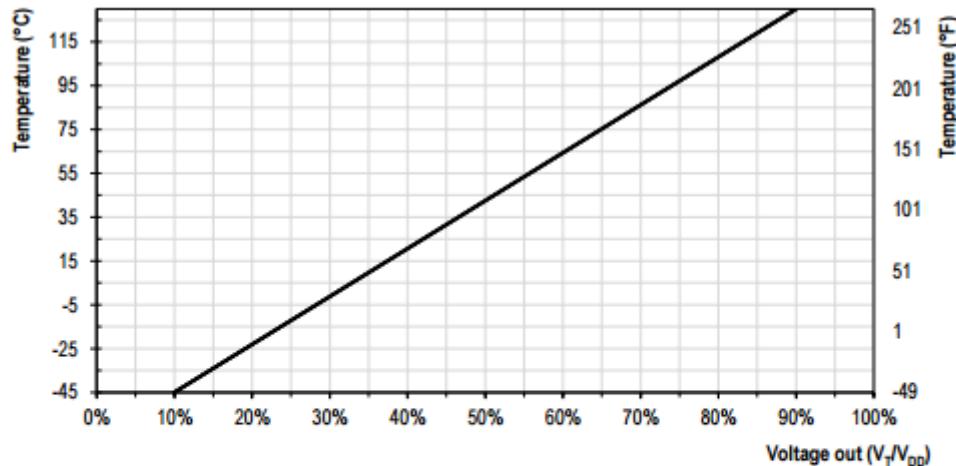


Figure 10 Relationship between the ratiometric analog voltage output and the measured temperature

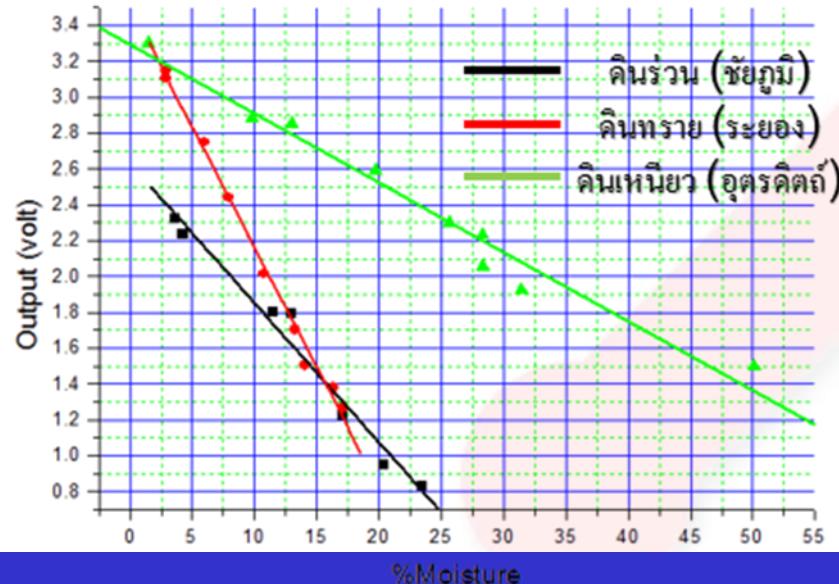
$$T [^{\circ}\text{C}] = -66.875 + 218.75 \cdot \frac{V_T}{V_{DD}} = -45 - \frac{17.5}{0.8} + \frac{175}{0.8} \cdot \frac{V_T}{V_{DD}} \quad (2)$$

$$T [^{\circ}\text{F}] = -88.375 + 393.75 \cdot \frac{V_T}{V_{DD}} = -49 - \frac{31.5}{0.8} + \frac{315}{0.8} \cdot \frac{V_T}{V_{DD}} \quad (3)$$

```
tempT = (vln1*2187.5)/voltref-6687.5;  
Serial.print("Temp ="); Serial.print(tempT,1);  
Serial.println(" C");
```

Exercise 1

Analog->Digital A5->Moisture

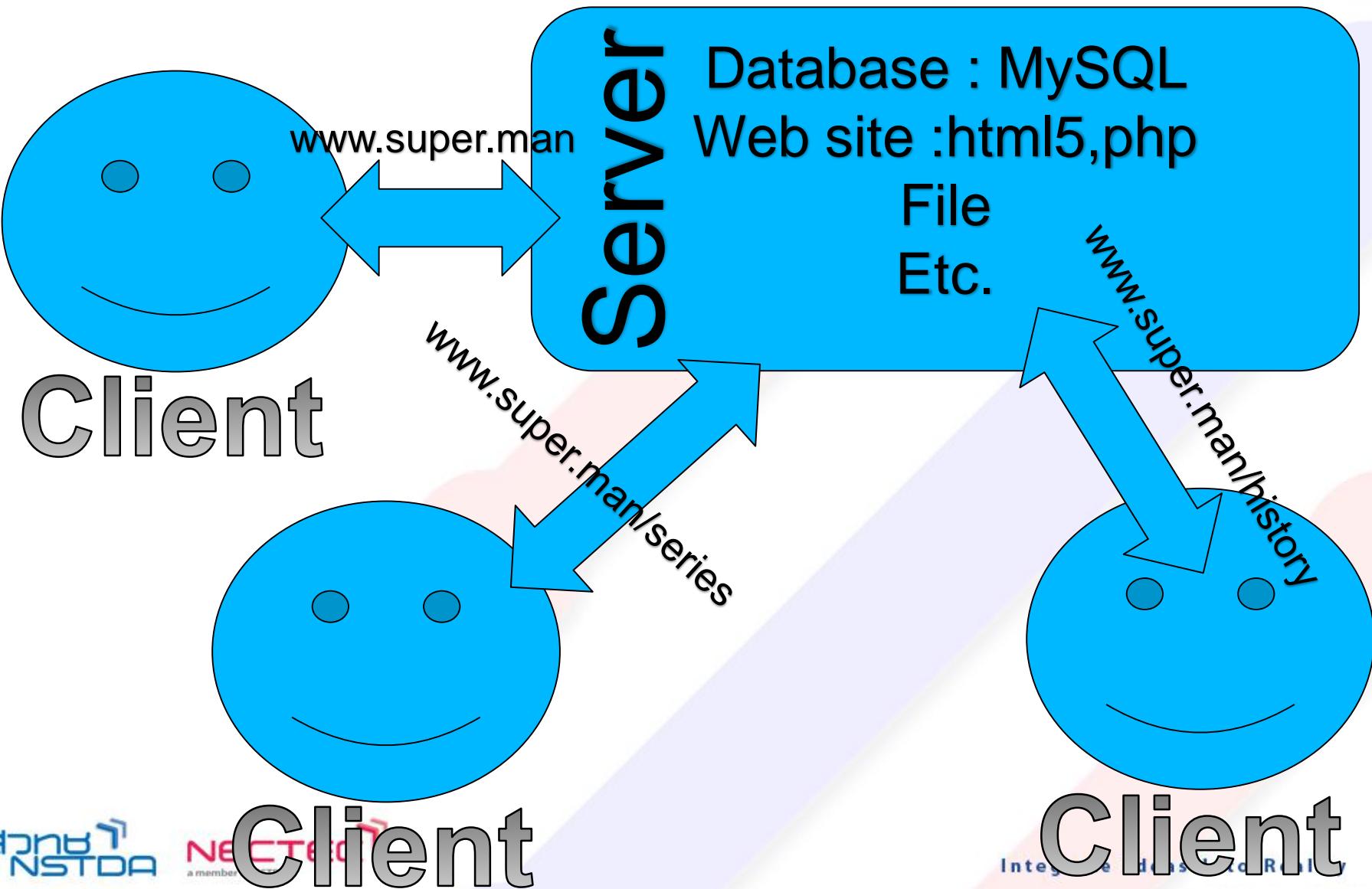


moisture = xx-(vln5*yy);

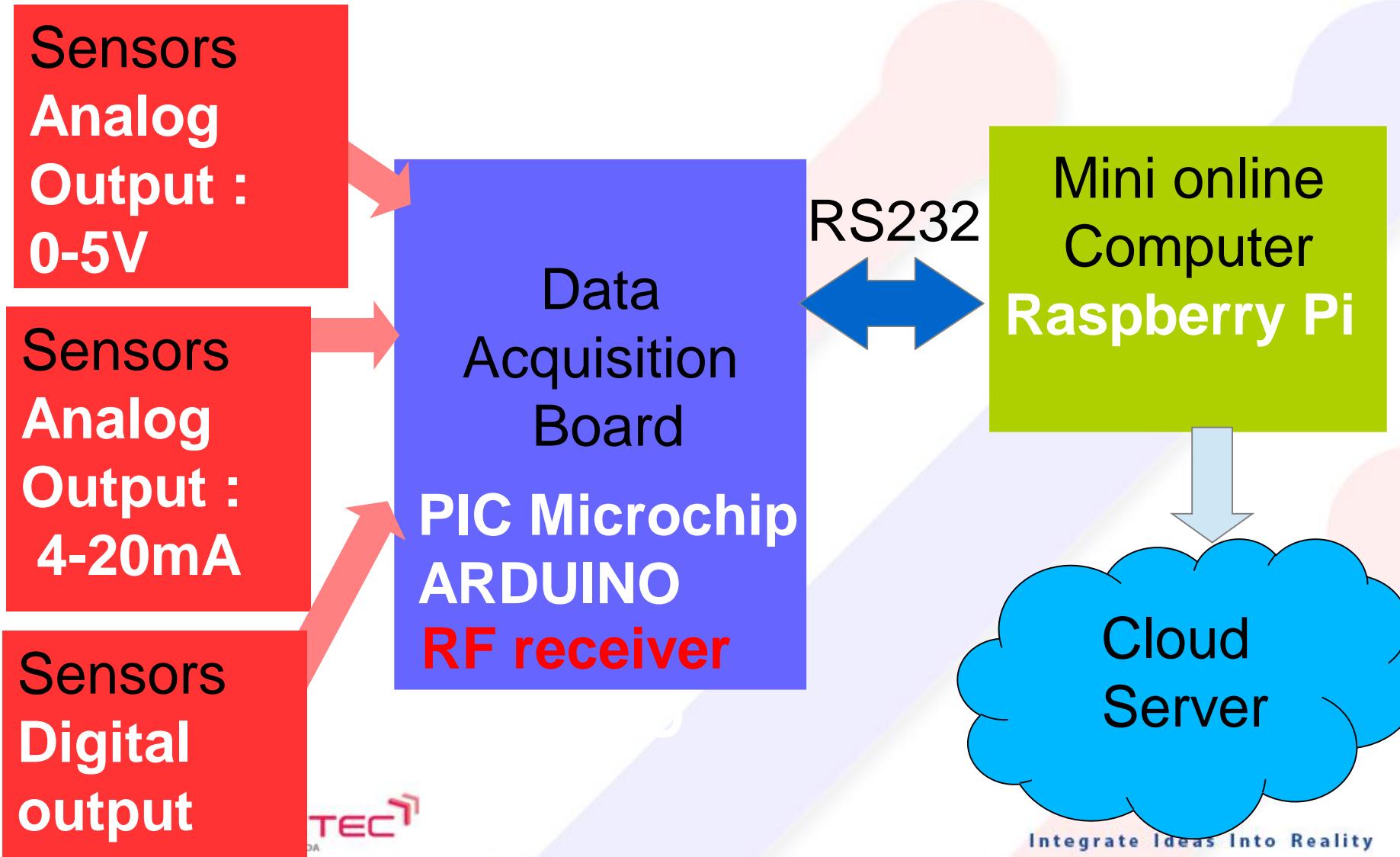
Serial.print("Moisture =");

Serial.print(moisture,1); Serial.println(" %");

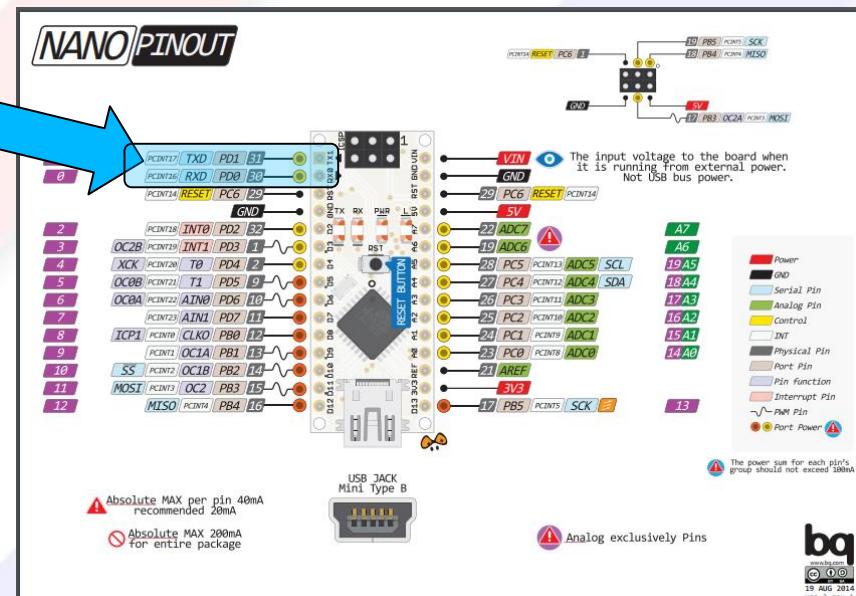
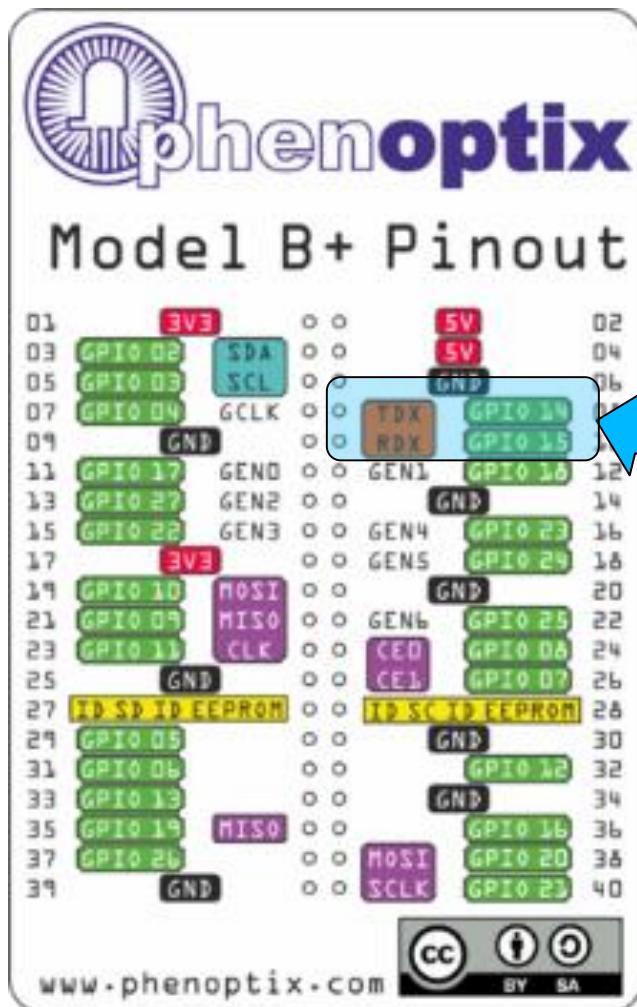
Server, Database



Master Sensor Network System



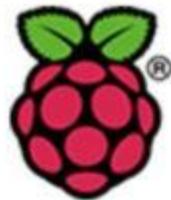
Mini online Computer Raspberry C



Serial Port (Rx, Tx)

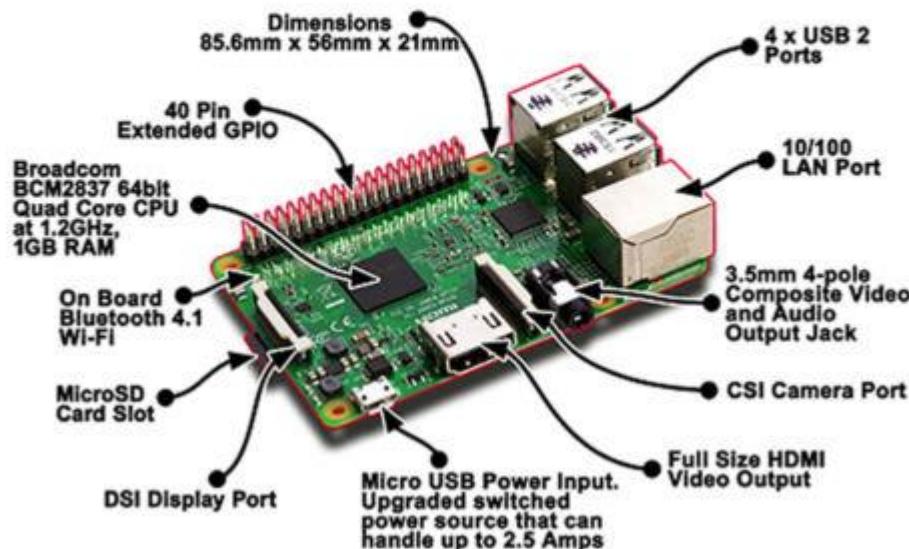


Raspberry Pi



Raspberry Pi 3 Model B

1.2GHz Quad-Core CPU , 1GB RAM , WiFi & BlueTooth



SD card : 16GB
 OS: Linux Jessie
 Php Server
 phpMyadmin :MySQL
 Python 2.7
 FTP

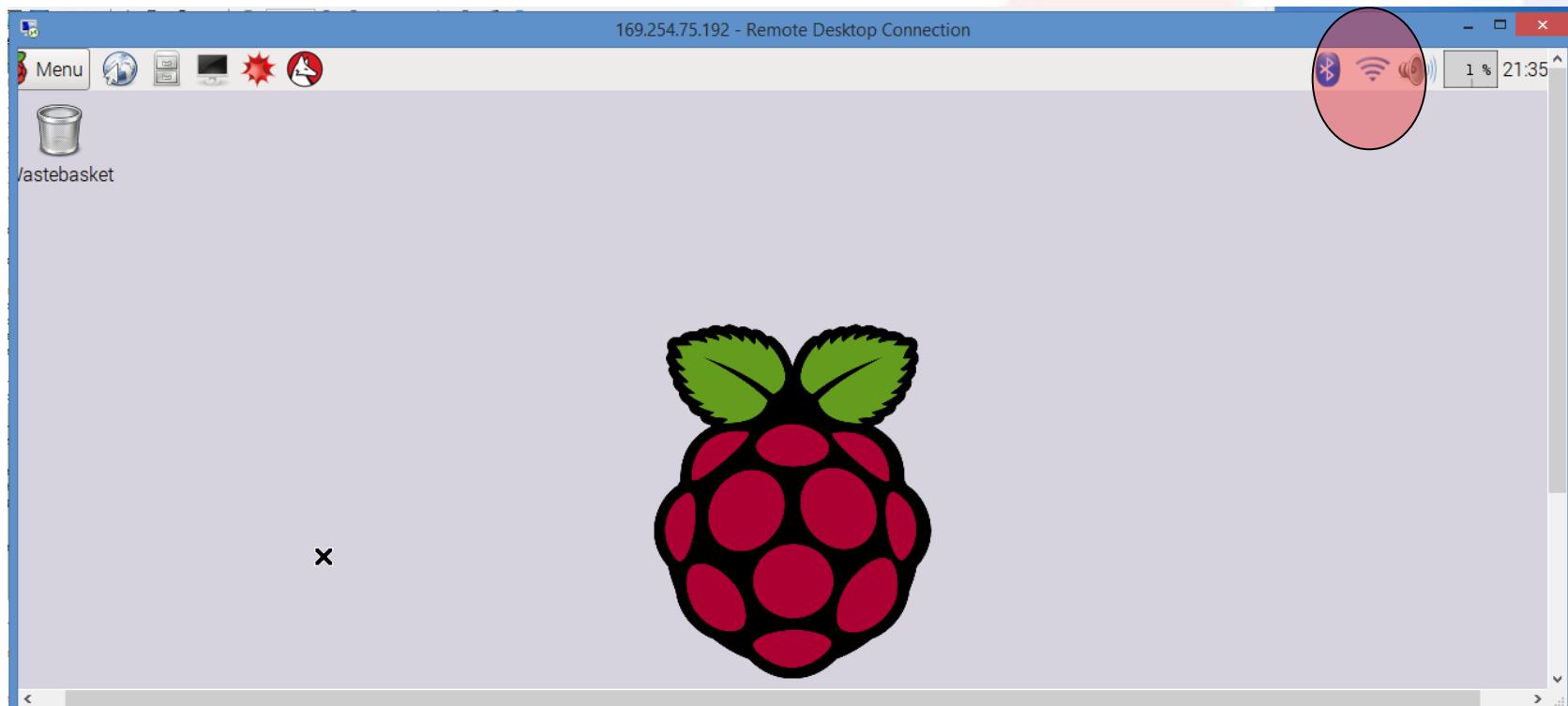
Windows Remote Desktop



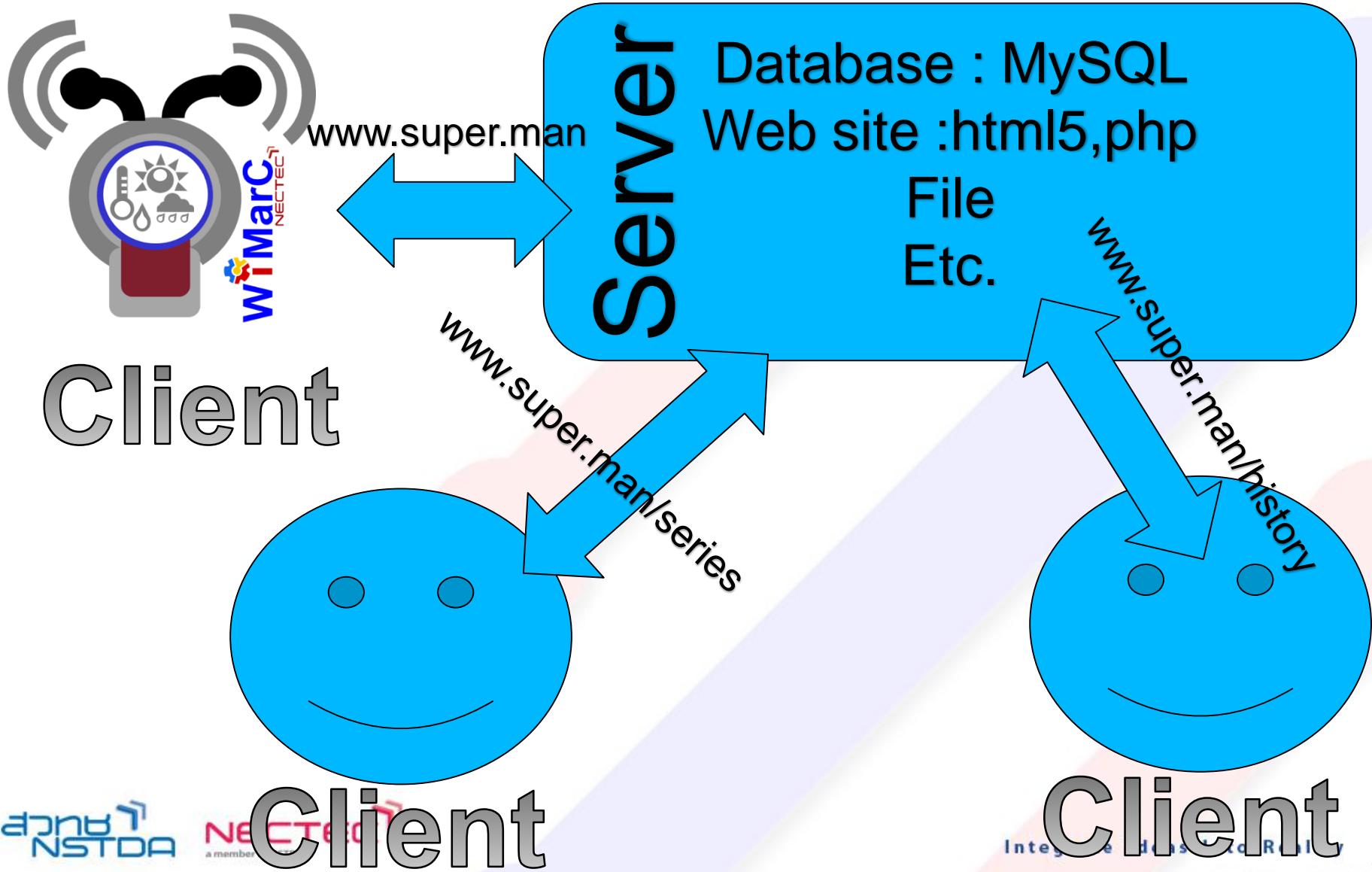
Username : pi

Password : raspberry

Wifi connect



Server, Database



Server, Database



Server

Database : MySQL
Web site : html5,php
File
Etc.

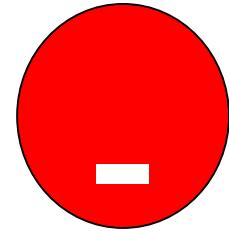
Client

IoT platform

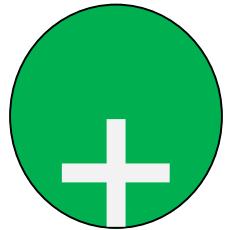


NETPIE
where things chat

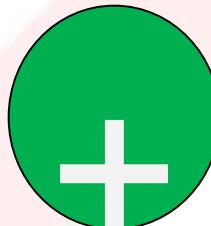
DB Server



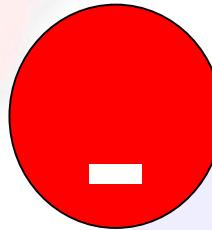
- slow
- long header



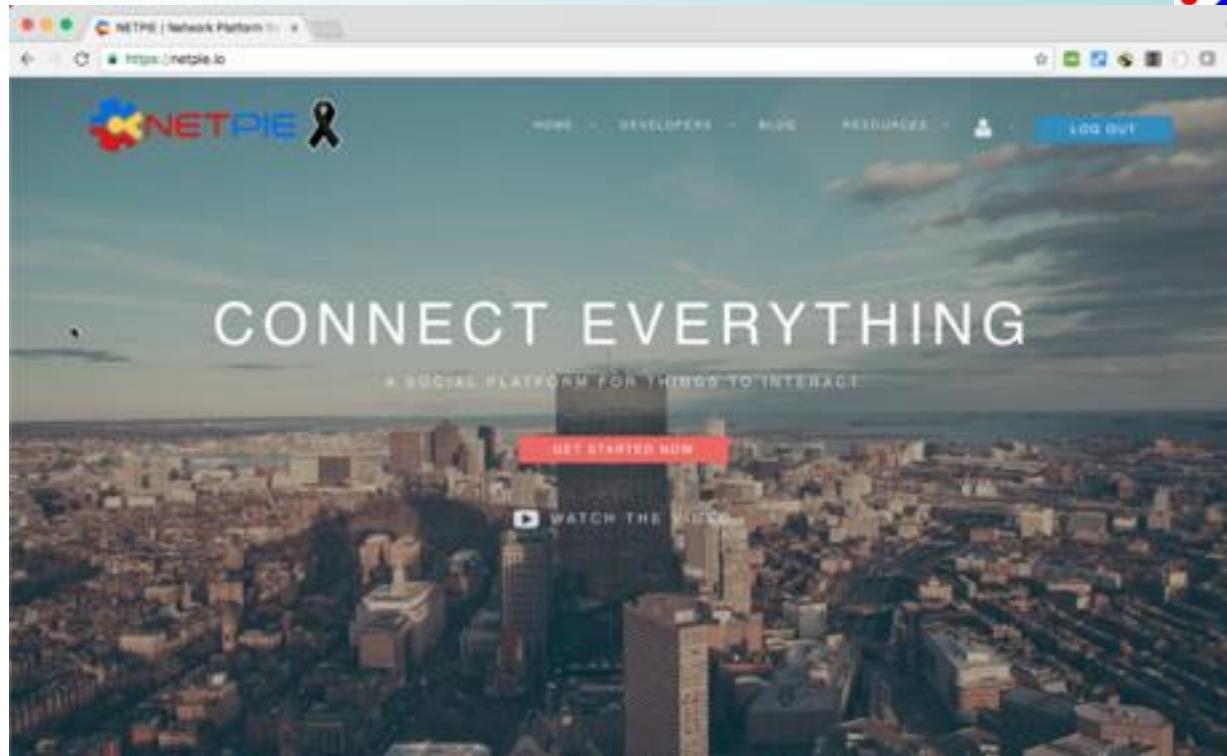
- DB flexible



-realtime



- DB not configurable



<https://netpie.io>

<https://github.com/netpiemaker/netpie-training>

ให้บริการฟรี 100 credits ตลอดไป

Application ID

APPID

APPLICATION (APPID)

iotdemo

DELETE

5

LOG OUT

APPLICATION KEY

Device Key, Session Key

HTML [online:0]

IOT Hardwares [online:0]

piebulb

Secure https://netpie.io/app/iotdemo

APPLICATION (APPID)

iotdemo

IOT Hardwares

Key : o5CD0GvWsiYxtIGY

Secret : 5qXX8tOnUstxtaTMAIU8DYgbx

REST API auth : o5CD0GvWsiYxtIGY:5qXX8tOnUstxtaTMAIU8DYgbx

NAME CANCEL

Key, Secret

Integrate Ideas Into Reality

NETPIE on Python

```
Wimarcfarm.py - D:\OPAS-2008DEC\0-2015weatherstation\002017WiMarcFarm\Wimarcfarm.py (2.7.11) - □ ×
```

File Edit Format Run Options Window Help

```
import datetime
import time
import pycurl
import os
import paramiko,sys
import pysftp
import RPi.GPIO as GPIO
import httplib

writepath = '/media/usb0/data.txt'

writepathlocal = '/home/pi/data.txt'

from time import strftime
rcvH=strftime("%Y-%m-%d ")
rcvS=strftime("%H:%M:%S ")
lastTime = datetime.datetime.now()
recordLastTime = lastTime.minute

-----php-----
host = 'wimarcfarm.000webhostapp.com' #insert your hostname

-----NETPIE-----
import microgear.client as client

gearkey = 'aaaaaaaaaaaaaaaaaa' #insert your key
gearsecret = 'bbbbbbbbbbbbbbbbbbbbbbbbbb' #insert your secret
appid = 'cccc' # insert your appid

headers = {
    'User-Agent': 'python',
    'Content-Type': 'application/x-www-form-urlencoded',
}

-----Connect to SerialPort-----

try :
    ser = serial.Serial('/dev/ttyS0', baudrate=9600, timeout=2000)
    ser.close()
except:      print "ERROR: Port not found!"
```

Free DB webserver

The screenshot shows a web browser window with multiple tabs open. The active tab is for 000webhost at https://www.000webhost.com. The page features a large banner with the text "Free Web Hosting" and "Zero cost website hosting with PHP, MySQL, Cpanel & no ads!". It includes a "Sign Up for FREE!" button and a review badge with a 4.9/5 rating from 2208 reviews. The navigation menu at the top includes "Free Hosting" (which is underlined), "Premium Web Hosting", "Earn Money", "Website Builder", and a "Free Sign Up" button.

The bottom of the screen shows a Windows taskbar with various pinned icons, including the Start button, File Explorer, and several application icons. To the right is the system tray with icons for battery, signal strength, volume, and language (ENG). The date and time are also displayed as 20/8/2560 13:55. A "Let's chat" button with a profile picture is visible on the right side of the taskbar.

Build your website



Free DB webserver



FTP details

Use these details to access and manage your website files. When FTP is disabled you can still use web file manager.

FTP transfer

OFF ON

Host Name:

files.000webhost.com

Username:

[nectecwimarcfarm](#)

Password:

same as your website password

Need more? Increase database size & quantity simply by upgrading to PRO!

Create & manage databases

Create new MySQL databases or manage your current databases using advanced PhpMyAdmin panel. You're also able to change passwords for your DB or completely remove DB.

Database is limited to: 1 GB of data and 150 tables.

Default database engine: InnoDB on MariaDB 10.1

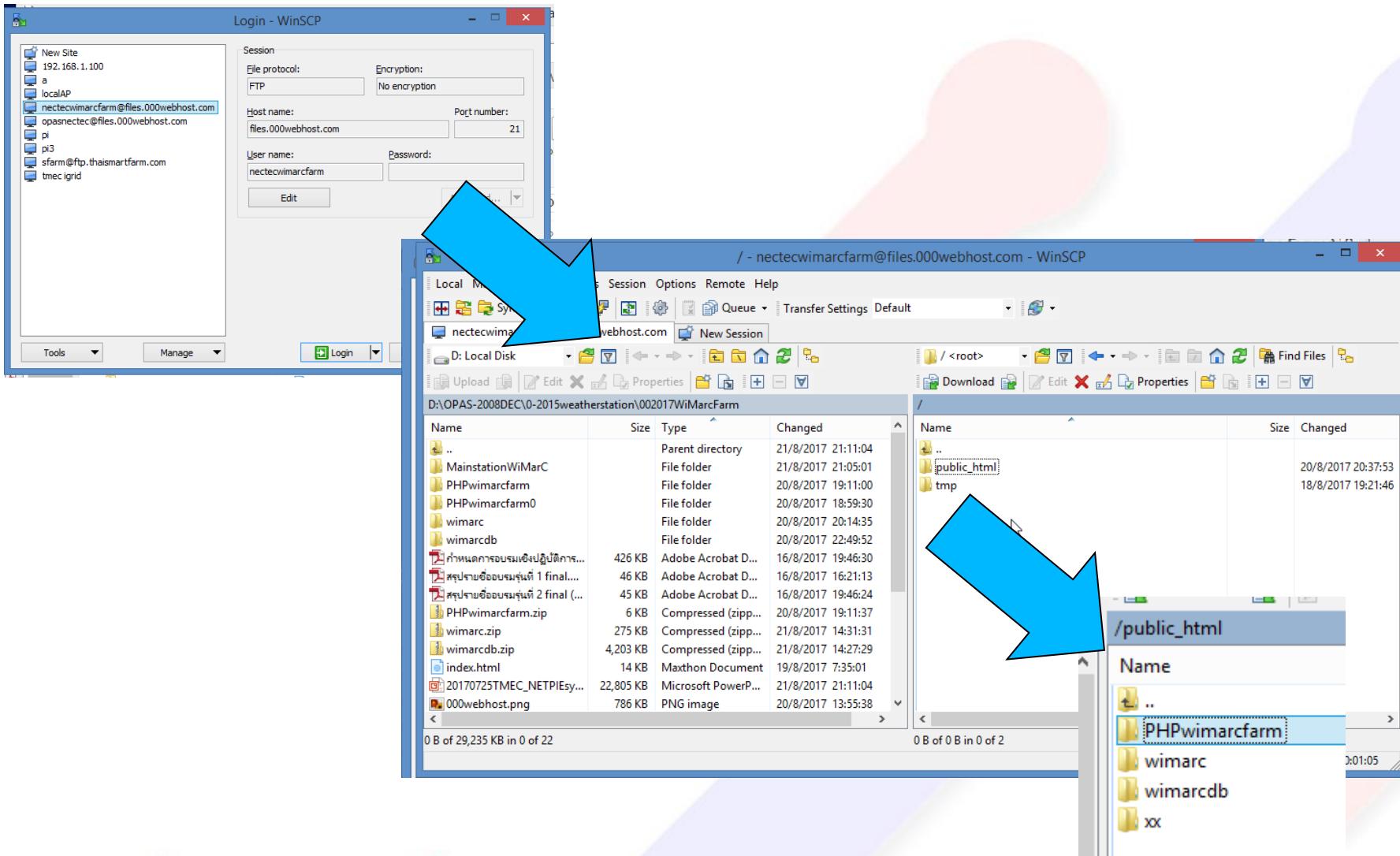
Manage databases at databases.000webhost.com

Use localhost as connection hostname

DB Name	DB User	DB Host	
id2613481_sensora	id2613481_wimarcfarm	localhost	Manage ▾

[New Database](#)

Upload file to server



MySQL database

Screenshot of the phpMyAdmin interface showing the database structure for 'id2613481_sensora'.

The left sidebar shows the database structure:

- New
- id2613481_sensora
 - New
 - a
 - b
 - c
 - d
 - device
 - e
 - f
 - g
 - h
 - humid
 - i
 - j
 - level
 - lux
 - moisture
 - rain
 - sensor
 - temp
 - volt

The main area displays the table list for the 'id2613481_sensora' database:

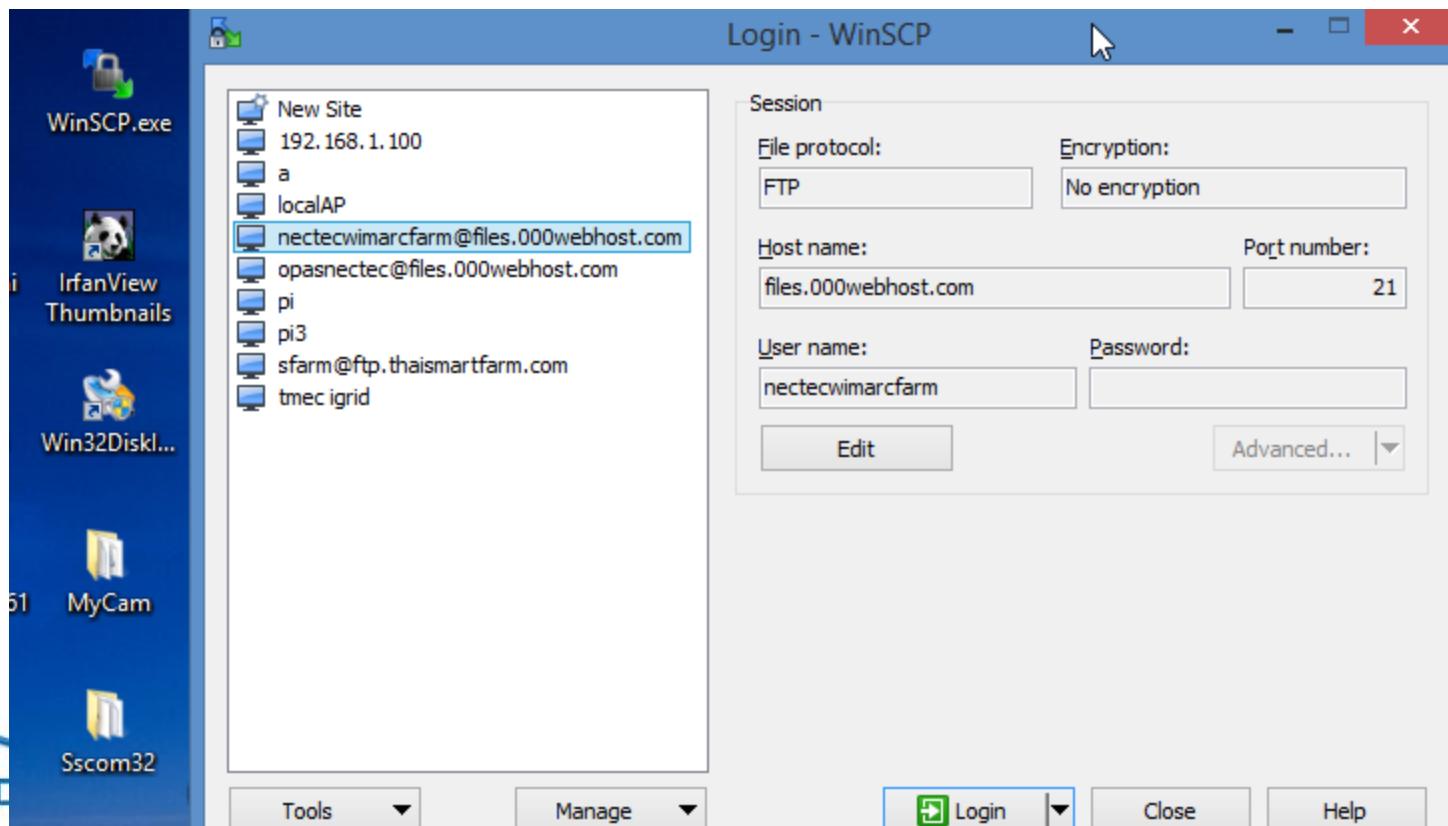
Table	Action	Rows	Type	Collation	Size	Overhead
a	Browse Structure Search Insert Empty Drop	63	InnoDB	utf8_unicode_ci	32 KiB	-
b	Browse Structure Search Insert Empty Drop	49	InnoDB	latin1_swedish_ci	16 KiB	-
c	Browse Structure Search Insert Empty Drop	39	InnoDB	latin1_swedish_ci	16 KiB	-
d	Browse Structure Search Insert Empty Drop	39	InnoDB	latin1_swedish_ci	16 KiB	-
device	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
e	Browse Structure Search Insert Empty Drop	39	InnoDB	latin1_swedish_ci	16 KiB	-
f	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
g	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
h	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
humid	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
i	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
j	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
level	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
lux	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
moisture	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
rain	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
sensor	Browse Structure Search Insert Empty Drop	39	InnoDB	latin1_swedish_ci	16 KiB	-
temp	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
volt	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-
Console	Browse Structure Search Insert Empty Drop	0	InnoDB	latin1_swedish_ci	16 KiB	-

Free DB webserver

FTP details

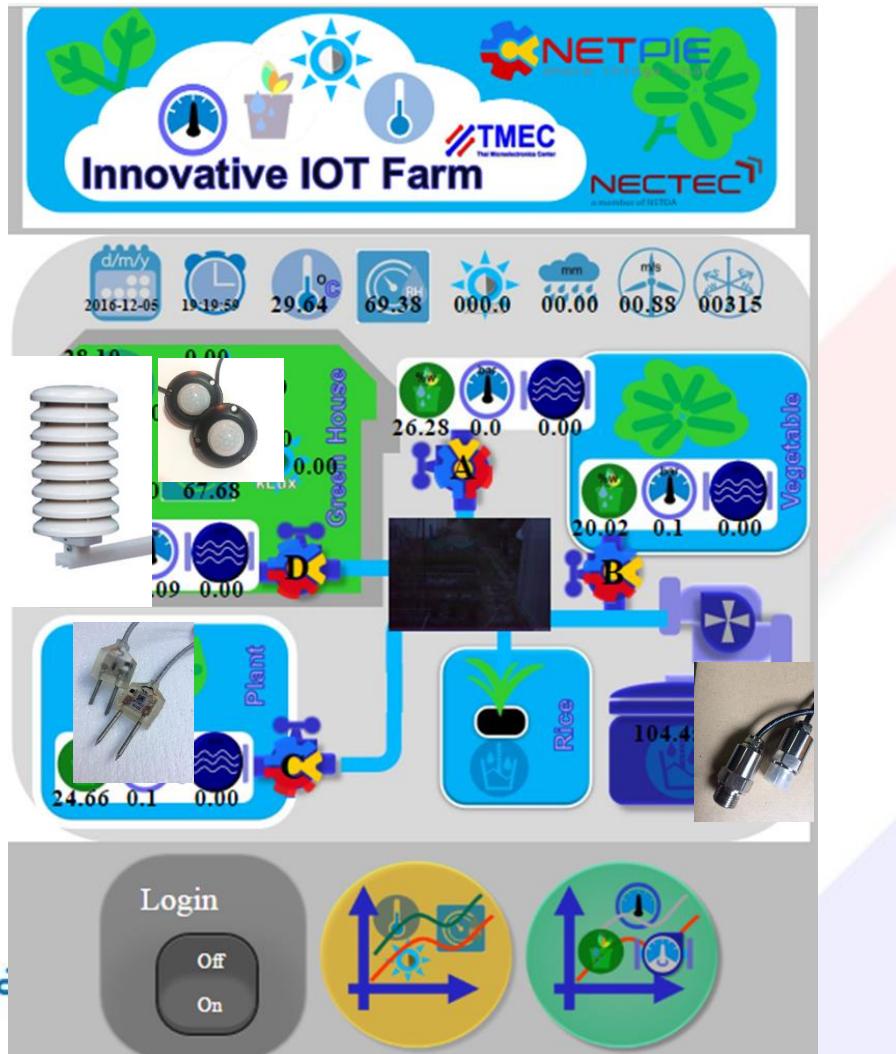
Use these details to access and manage your website files. When FTP is disabled you can still use web file manager.

FTP transfer ON
Host Name: files.000webhost.com
Username: nectecwimarcfarm
Password: same as your website password



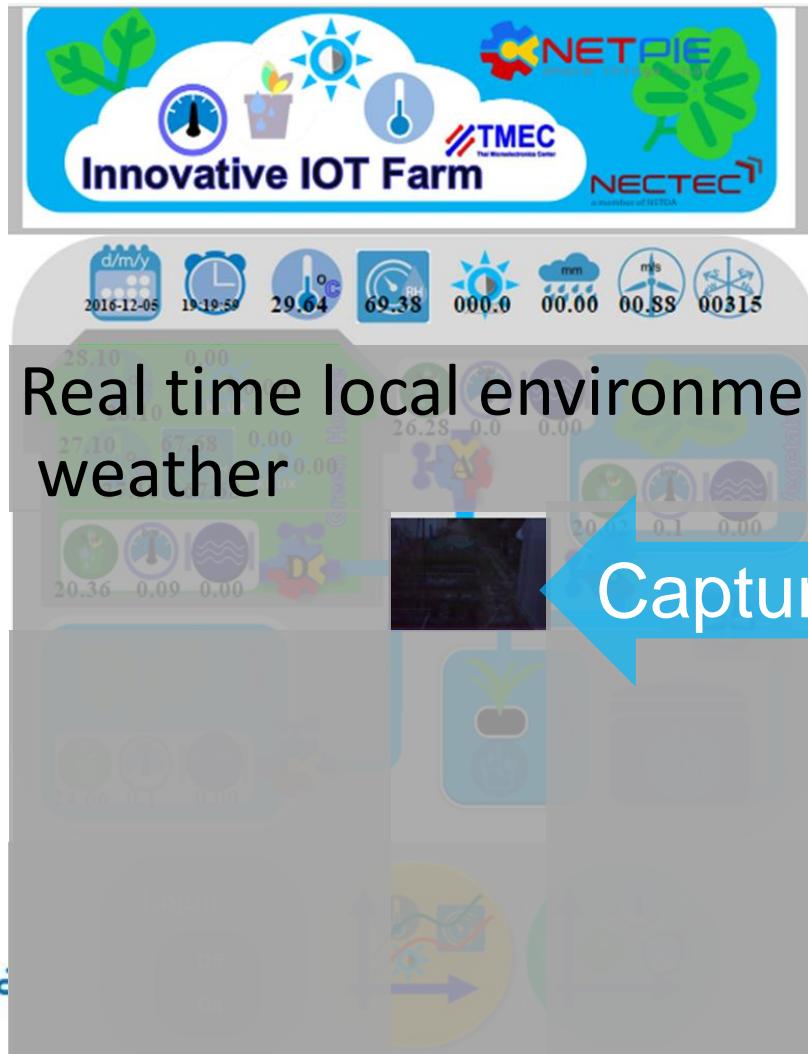
Precision Environment Monitoring

<http://tmecc.igridproject.info/tmecfarm.php>



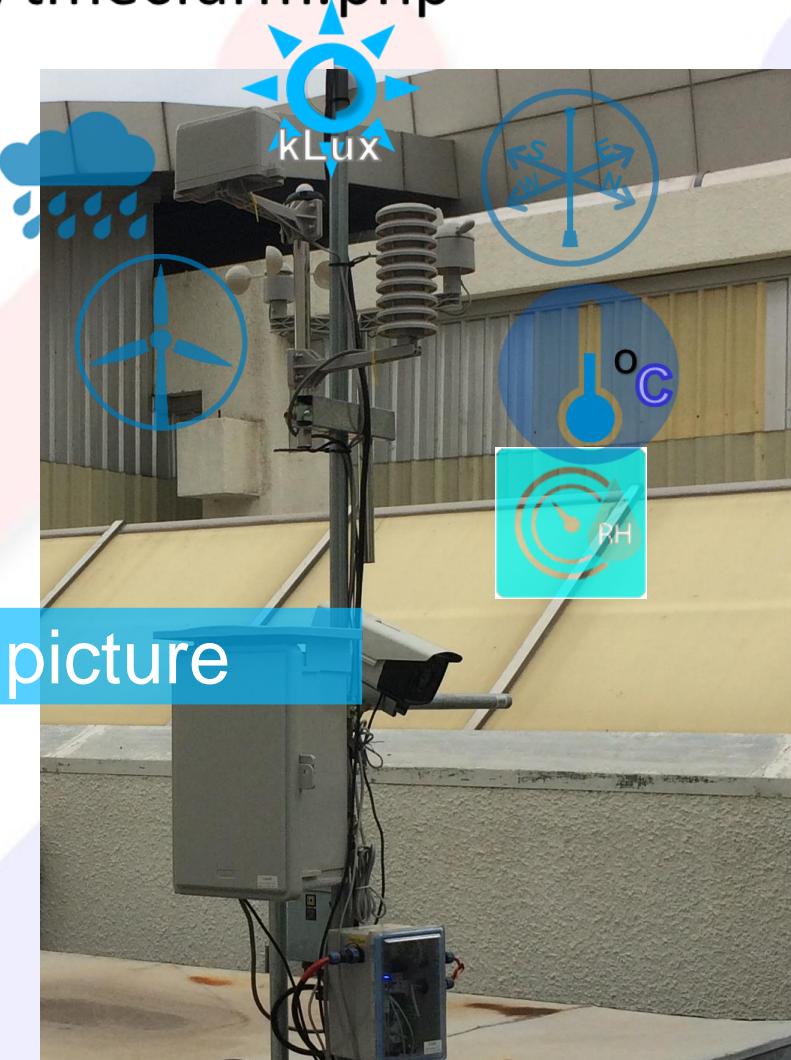
Real Time Monitoring

<http://tmech.igridproject.info/tmecfarm.php>



Real time local environmental weather

Captured picture



Real Time Monitoring

<http://tmech.igridproject.info/tmecfarm.php>

Real time environmental monitoring at specific area



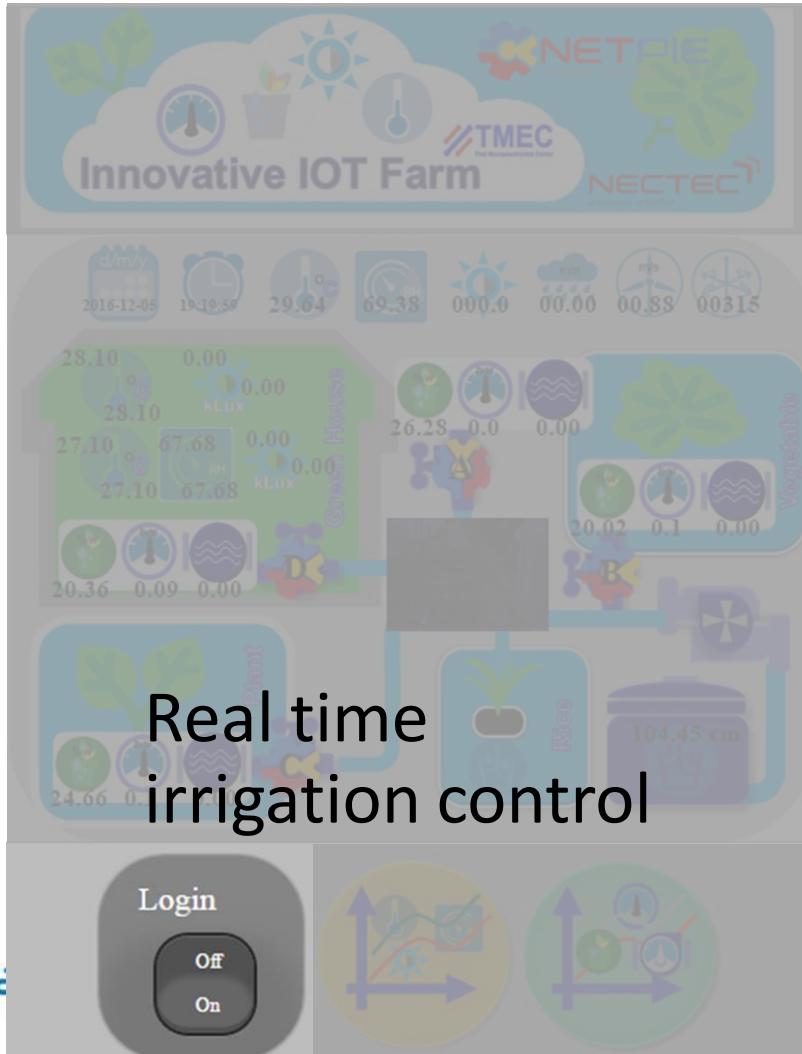
Login

Off
On



Real Time Control

<http://tmech.igridproject.info/tmecfarm.php>



The screenshot displays a dashboard titled "Innovative IOT Farm" featuring various sensors and data points. Key data includes:

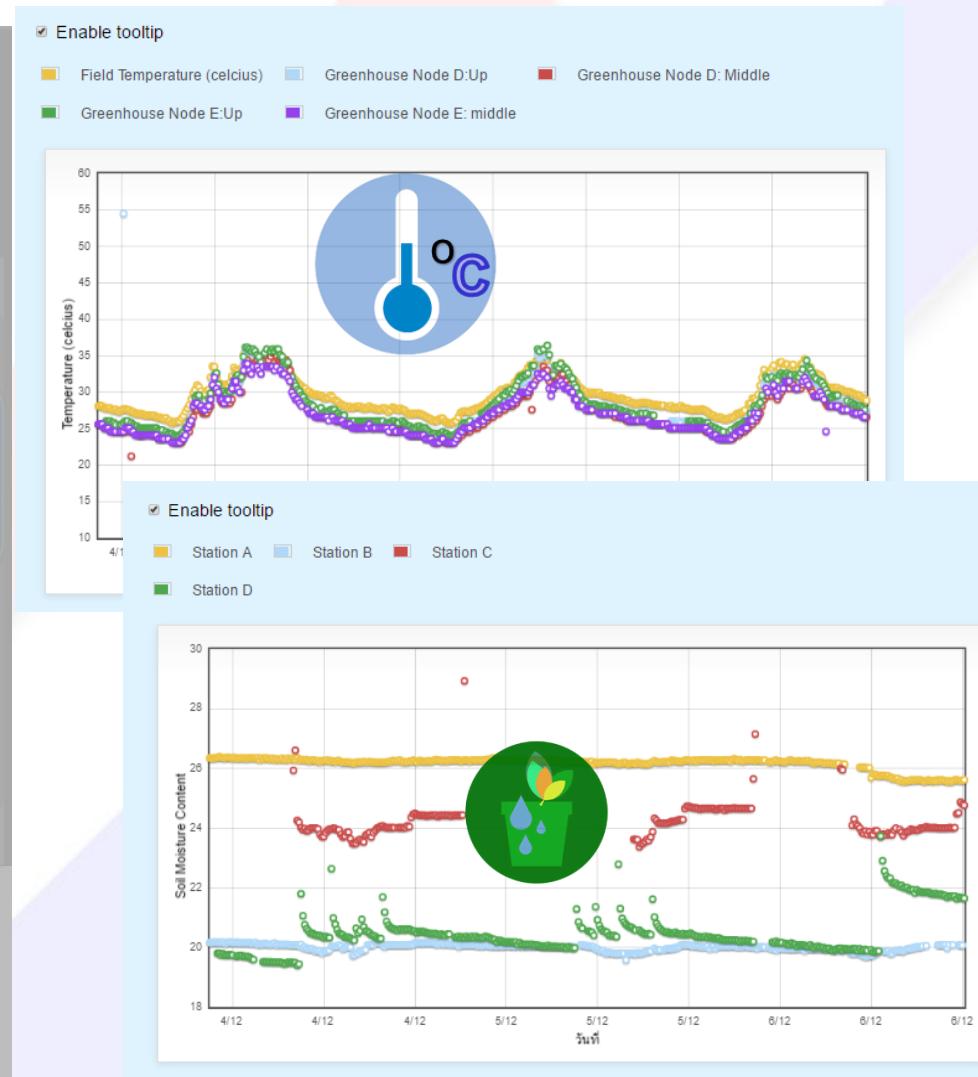
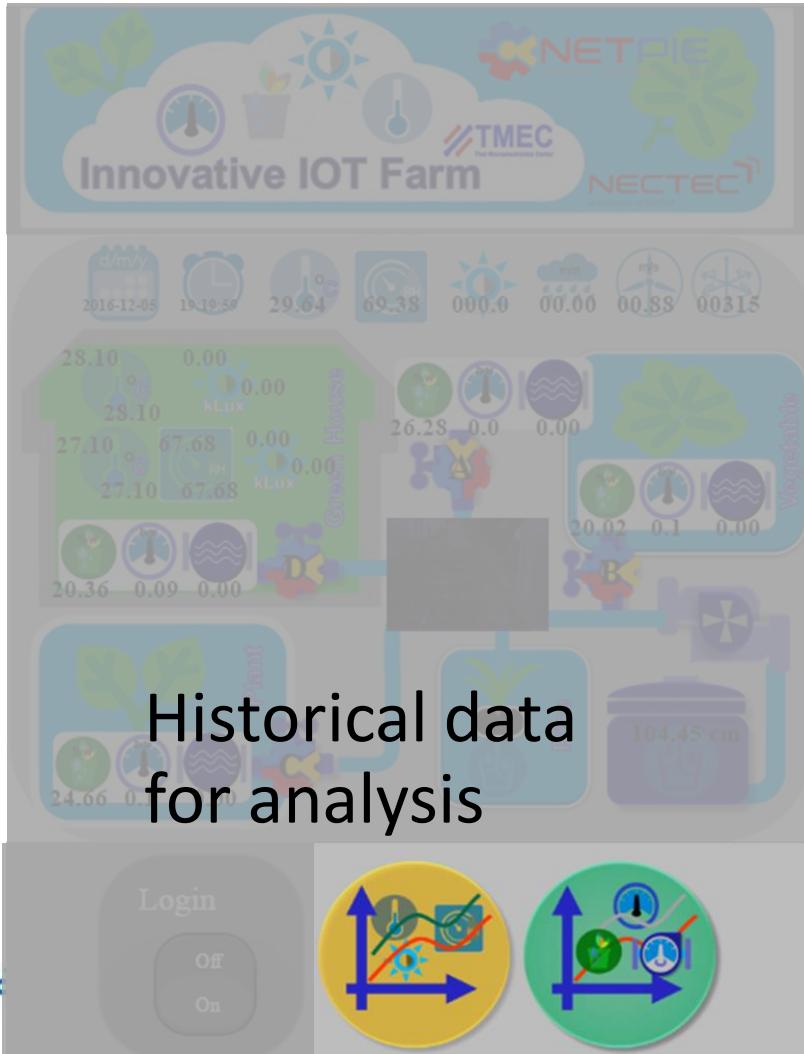
- Date: 2016-12-05
- Time: 19:19:57
- Temperature: 29.64
- Humidity: 69.38
- Rainfall: 000.0
- Wind Speed: 00.88
- Wind Direction: 00315
- Light Intensity (Green House): 28.10, 0.00, 0.00 kLux
- Light Intensity (Vegetable): 26.28, 0.00, 0.00 kLux
- Temperature (Green House): 28.10, 27.10, 27.10 °C
- Humidity (Green House): 0.00, 0.00, 0.00
- CO₂ (Green House): 20.36, 0.09, 0.00 ppm
- PH (Vegetable): 67.68
- Light Intensity (Vegetable): 67.68 kLux
- Water Level: 104.45 cm

A large text overlay on the dashboard reads "Real time irrigation control". Below the dashboard are two circular icons: one for "Login" with "Off" and "On" buttons, and another for "Control" with a graph and arrows.



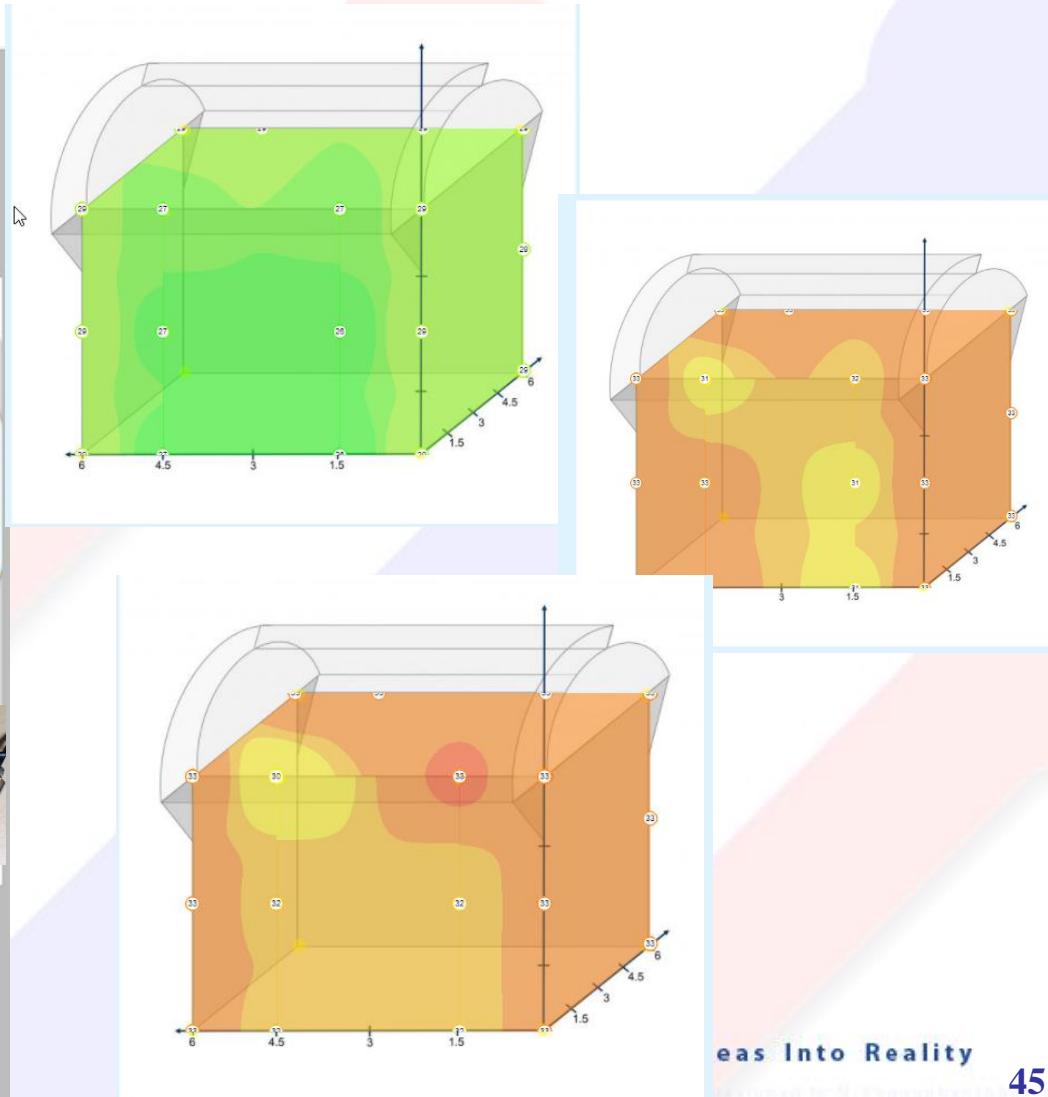
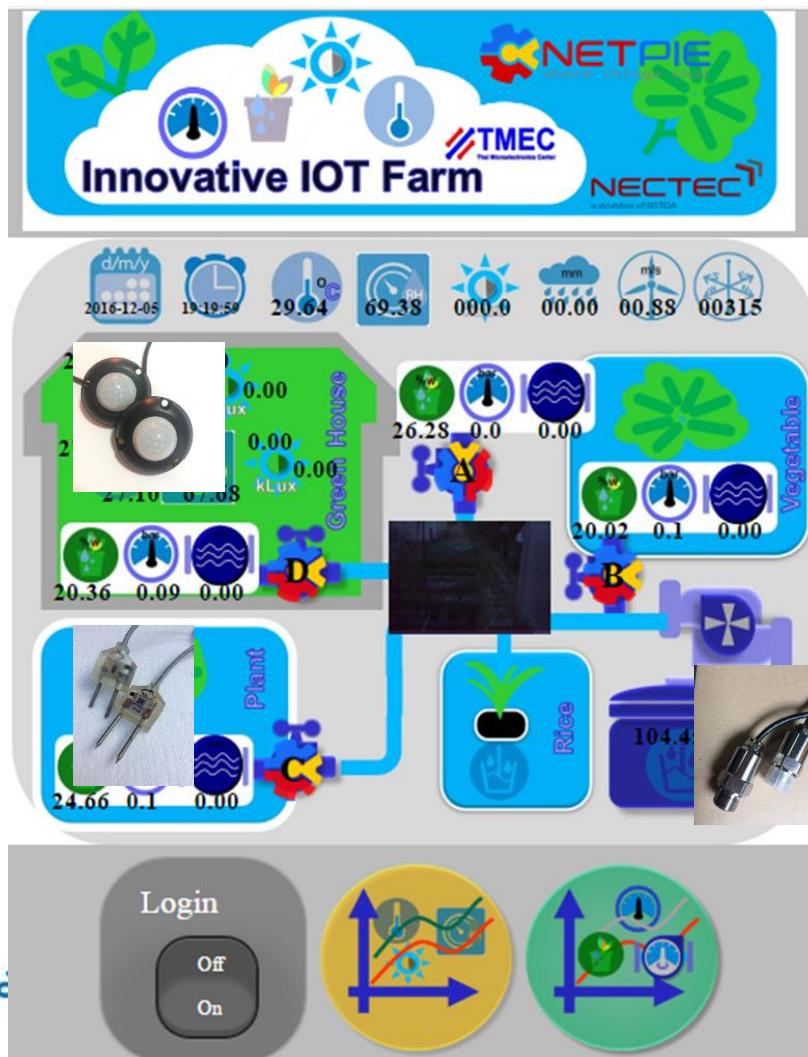
Historical Data

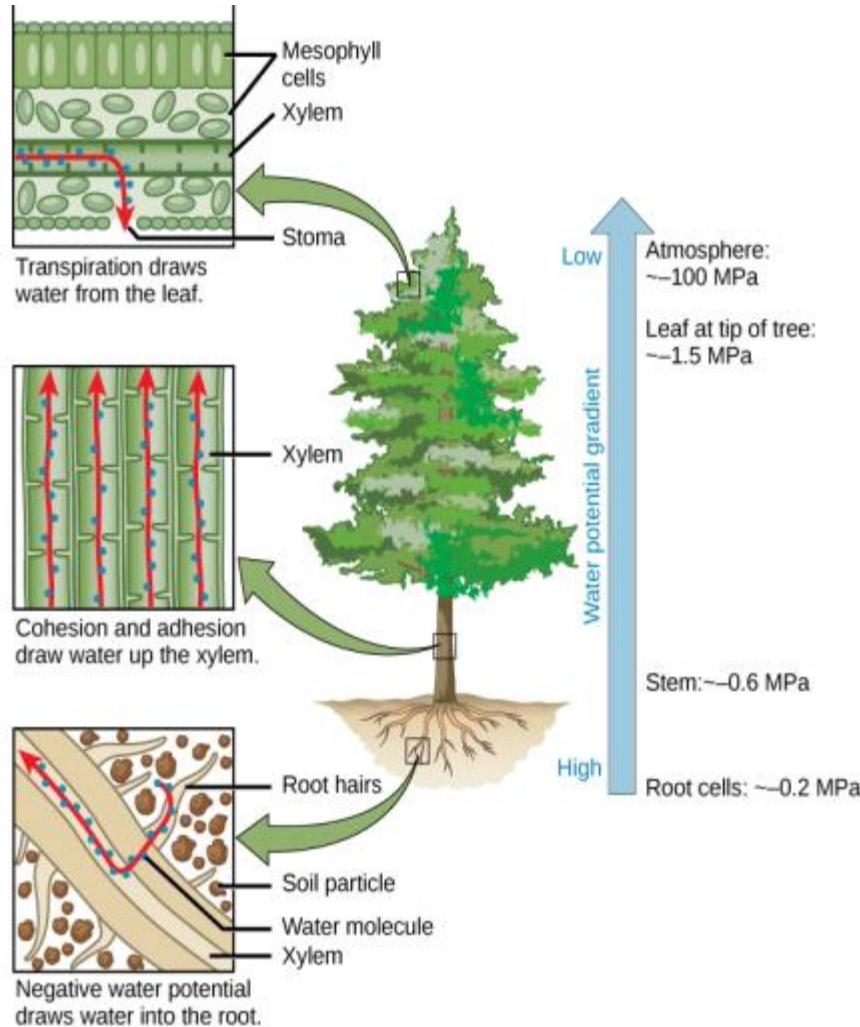
<http://tmech.igridproject.info/tmecfarm.php>



Innovative IoT Farm System

<http://tmech.igridproject.info/tmecfarm.php>





-In-Plant Measurement

Sap Flow Monitoring with Micro Sensors



Th a n K s

<http://tmeconnect.nectec.or.th>
opas.trithaveesak@nectec.or.th

