

INTERNET OF THINGS (IoT) - DEVELOPMENT SOLUTION

The Internet of Things (IoT) is a system, Combination of Embedded controllers, sensors, Softwares and Network. Simply it merges the physical objects with online world.

In the rapidly growing Internet of Things (IoT), applications from personal electronics to industrial Machines and sensors are getting wirelessly connected to the Internet.

The IoT Issues:

- * Covering a wide variety of usages
- * Various environments like agriculture, Healthcare, etc.,
- * Serving diverse requirements
- * No Single Wireless standard can adequately prevail
- * Numerous Wireless Standards deployed in the market
- * Spreading over multiple frequency bands
- * Using different communication protocols.

We have designed an innovative IoT development System Consists of

- * >15 sensors for Different Applications

Wireless Topology

- * Many Wireless sensor nodes to connect with IoT Gateway
 - # Zigbee sensor Node
 - # Wifi sensor Node
 - # Bluetooth sensor Node
 - # RFID Node
 - # LoRaWAN Node
 - # Coordinator for Zigbee sensor Node

Gateways

- * Broadcom BCM 2837 based Gateway
- * ARM AM3358 based Gateway
- * Siemens IoT 2020/2040 Based Gateway

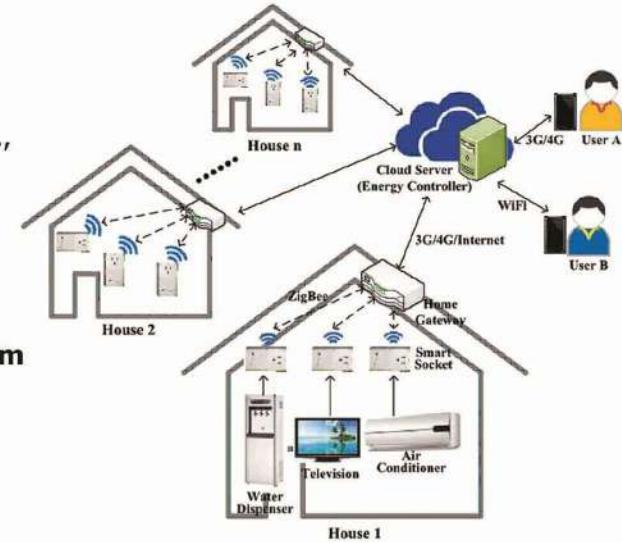
Big Data

- * Cloud Server
- * Cloud based Analytic Software

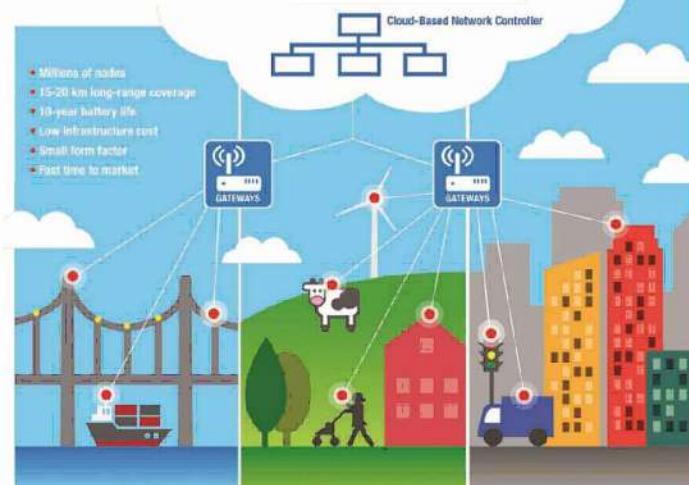
IoT systems have plenty of following functional blocks, which have been implemented in our IoT solution.

Our IoT Development System focus for the students on i) Porting of OS onto the hardware offered ii) Developing device driver for all the modules iii) Cloud servers iv) Big Data Analytics v) Choosing the Right Gate Ways.

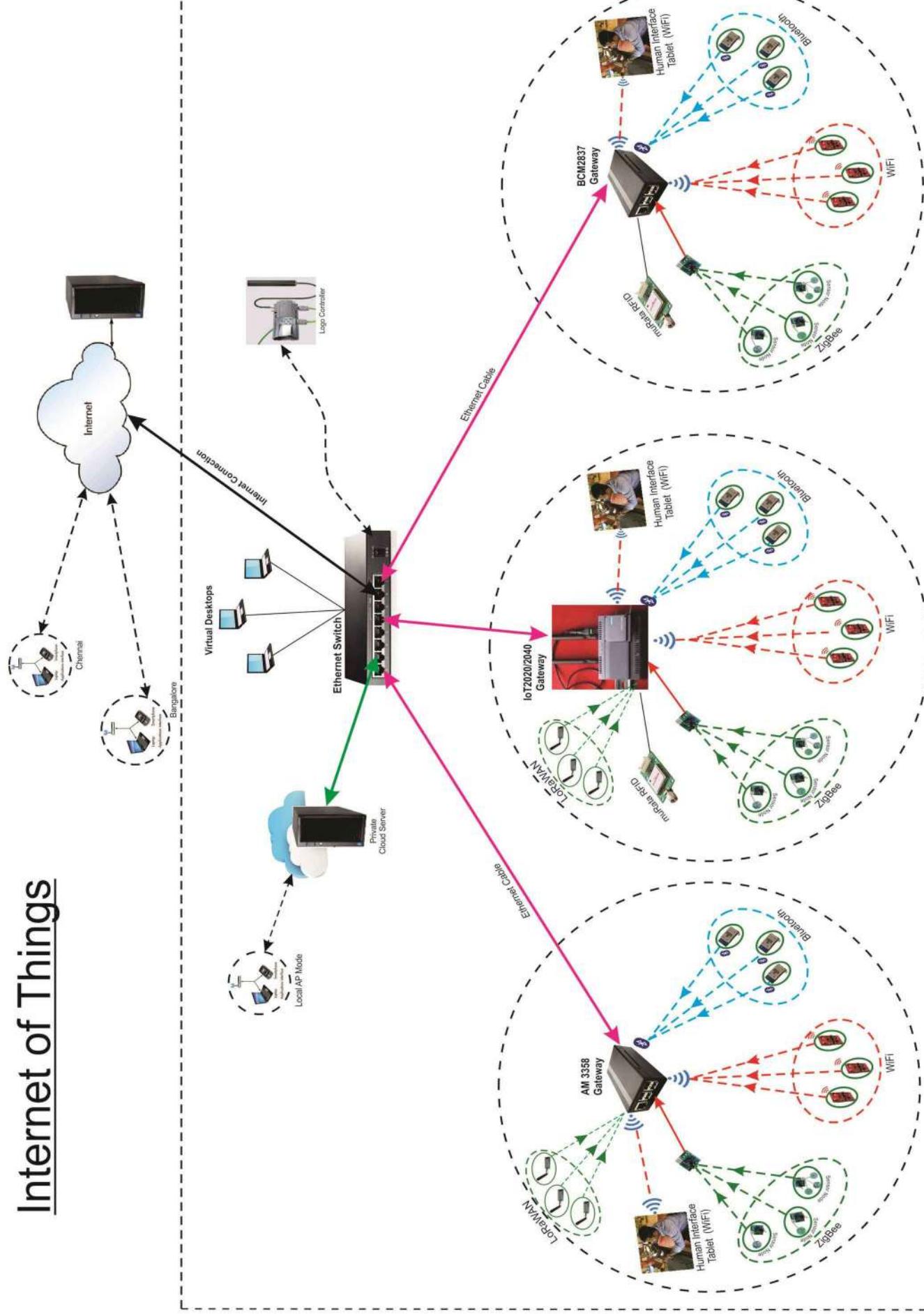
The students can develop and implement the Zigbee protocol stack, with different type of network topologies like mesh Networking, Tree Topology etc., using ARM Cortex M3 based Zigbee sensor nodes.



LoRa™ End-Node SolutionTM For Long Range and Low Power IoT Networks.



Internet of Things



Component of IOT Trainer.

- i. IOT Gateways
- ii. Embedded Controllers with Wireless Connectivity
- iii . Basic Sensors
- vi. Special Sensors Modules & Actuators
- v. Advanced Sensors Modules
- vi. Application Based IOT Trainers
- vii. Other specific purpose IOT Trainers
- viii Private Cloud Server

i. IOT GATEWAYS

1a. Raspberry Pi 4

Specifications:

- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- 2GB LPDDR4-3200 SDRAM
- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE
- Gigabit Ethernet
- 2 USB 3.0 ports; 2 USB 2.0 ports.
- Raspberry Pi standard 40 pin GPIO header (fully backwards compatible with previous boards)
- 2 x micro-HDMI ports (up to 4kp60 supported)
- 2-lane MIPI DSI display port
- 2-lane MIPI CSI camera port
- 4-pole stereo audio and composite video port
- H.265 (4kp60 decode), H264 (1080p60 decode, 1080p30 encode)
- OpenGL ES 3.0 graphics
- Micro-SD card slot for loading operating system and data storage
- 5V DC via USB-C connector (minimum 3A*)
- 5V DC via GPIO header (minimum 3A*)
- Power over Ethernet (PoE) enabled (requires separate PoE HAT)
- Operating temperature: 0 – 50 degrees C ambient



1b. 7 Inch Capacitive Touch Screen LCD HDMI Interface Display Shield for Raspberry Pi

Specifications:

- Support 7 inch Screen Resolution :1024x600
- Capacitive Touch Control
- HDMI Interface for Display
- USB Interface for Touch Control
- Useful to display sensors output Locally



1c. Camera 8 Mega Pixel

Specifications:

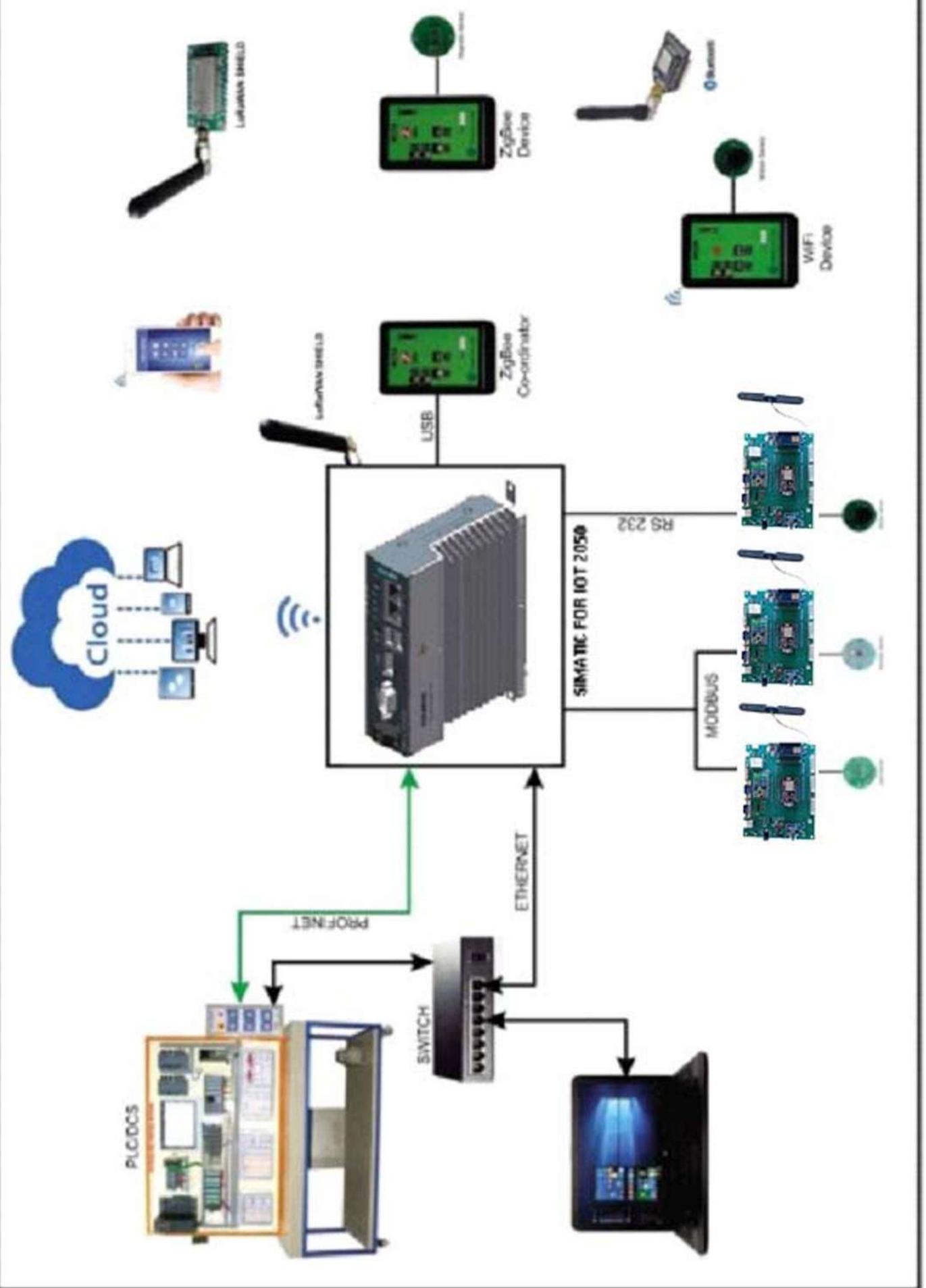
- Sony IMX477R stacked, 8 megapixels, 7.9 mm sensor diagonal, $1.55 \mu\text{m} \times 1.55 \mu\text{m}$ pixel size
- Lens standards: C-mount, CS-mount (C-CS adapter included)
- IR cut filter: Integrated
- Ribbon cable length: 200 mm
- Tripod mount: 1/4"-20

2. SIEMENS IOT 2050 BASIC GATEWAY BASED IOT DEVELOPMENT SYSTEM

Specifications:

- Processor type: ARM TI AM6528 GP(2 CORE)
- Graphics controller: Integrated
- Slot for drives: 1x microSD card slot
- Type of memory: DDR4
- Main memory: 1 GB RAM
- Capacity of main memory, max.:1 Gbyte
- free slots: 1x Arduino, 1x mPCIe
- Number of digital inputs: 20
- Type of input voltage: DC
- Number of digital outputs: 20
- Output voltage
- Type of output voltage :DC
- permissible voltage at output, min.: 3.3 V
- permissible voltage at output, max.: 5 V
- PROFIBUS/MPI can be implemented with plug-in card
- Number of industrial Ethernet interfaces : 2
- Number of PROFINET interfaces: 2
- USB port: 2x USB 2.0
- Connection for keyboard/mouse: USB
- serial interface: 1x COM (1x RS 232 / 422 / 485)
 - Graphics interface: 1x DisplayPort
 - Industrial Ethernet interface : 2x Ethernet (RJ45)





Add on modules in IoT2050

- 2Nos of RS485 slave modules with feature like
- 2 Nos of Analog Inputs
- 2 Nos of Digital Inputs and 2 Nos of Digital Outputs
- RS485 port with modbus in 9 pin D connector
- 1No of RS232 module with feature like
 - 2 Nos Analog Inputs
 - 2 Nos of Digital Inputs and 2 Nos of Digital Outputs
 - RS232 port in 9 pin D Connector
- 1 No of LoRaWAN Coordinator
- 1 No of Zigbee Coordinator
- All the above integrated in a single panel.
- External Wireless Sensor Interface Modules

One Wi-Fi End Device with sensor

- API or AT command configuration
- 4 Channel ADC for connecting sensors with 10 bit resolution
- 802.11 b/g/n standard
- 1Mbps data rate
- Up to 309mA Transmit current
- Power supply : Battery/External 5V
- Analog input range : 0 to 1.25V(Max)
- Sensor : Temperature

One Zigbee End Device with sensor

- API or AT command configuration
- 4 Channel ADC for connecting sensors with 10 bit resolution
- 802.15.4 protocol
- 250Kbps data rate
- 35mA Transmit current
- Power supply : Battery/External 5V
- Analog input range : 0 to 1.25V(Max)
- Sensor : LDR



One LoRaWAN End Device with sensor

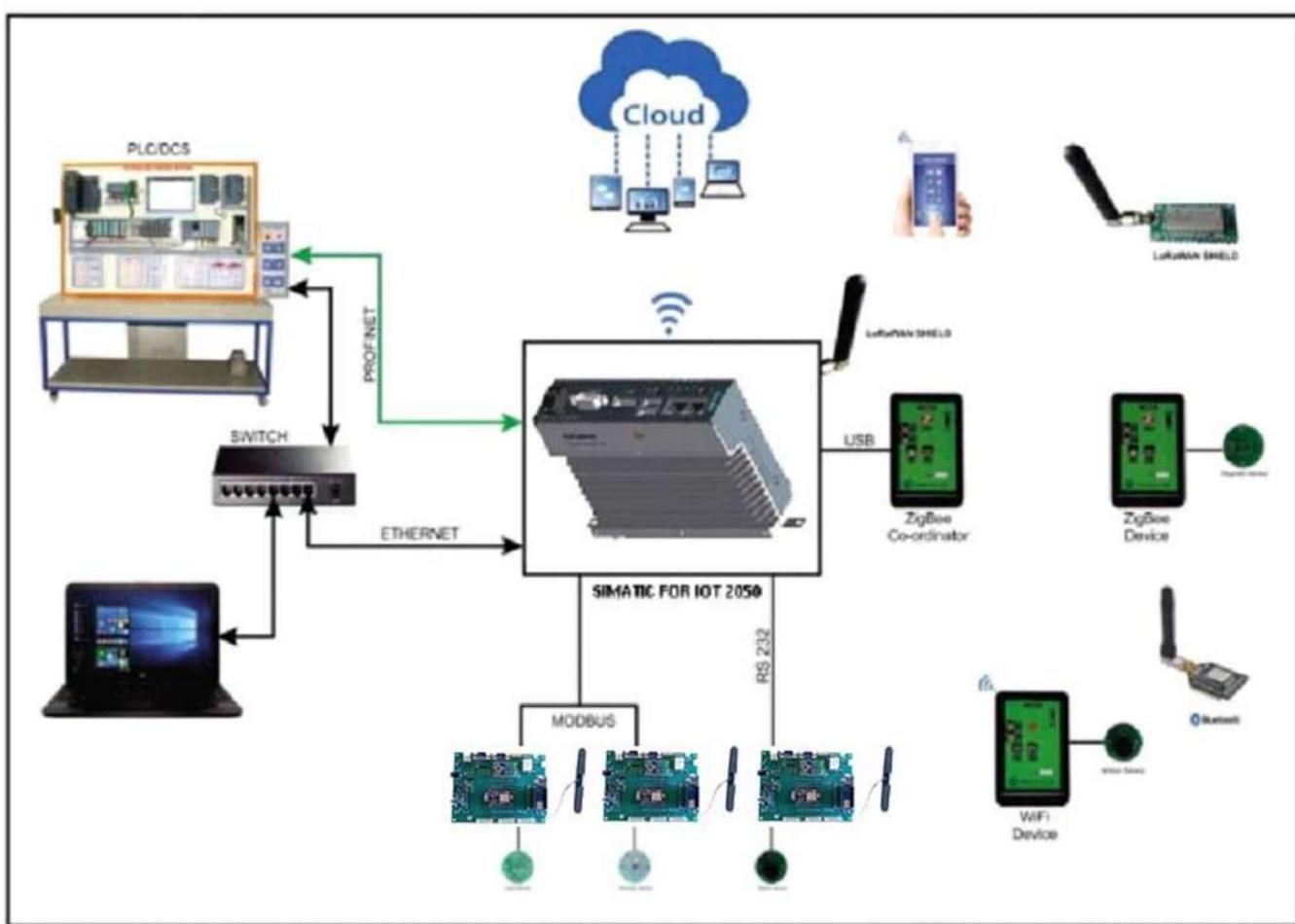
- LoRa WAN is a media access control (MAC) protocol for WAN
- LoRaWAN uses lower radio frequencies with 8 longer ranges
- LoRaWAN uses the 863-870 MHz
- Long range greater than 1km
- Secured and efficient network
- The data rate can be varies from 0.3kbps to 27kbps for 125KHz BW
- 14 GPIO pins for control, status and ADC
- Sensor : Temperature

NOTE:

One computer with Windows Operating System and wired Internet Communication without firewall protection is required for demonstration

3. SIEMENS IOT 2050 INTELLIGENT GATEWAY BASED IOT DEVELOPMENT SYSTEM

- Processor type: ARM TI AM6528 HS(4 CORE)
- Graphics controller: Integrated
- Slot for drives: 1x microSD card slot
- Type of memory: DDR4
- Main memory: 2 GB RAM
- Capacity of main memory, max.:2 Gbyte
- free slots: 1x Arduino, 1x mPCIe
- Number of digital inputs: 20
- Type of input voltage: DC
- Number of digital outputs: 20
- Output voltage
- Type of output voltage :DC
- permissible voltage at output, min.: 3.3 V
- permissible voltage at output, max.: 5 V
- PROFIBUS/MPI can be implemented with plug-in card
- Number of industrial Ethernet interfaces : 2
- Number of PROFINET interfaces: 2
- USB port: 2x USB 2.0
- Connection for keyboard/mouse: USB
- serial interface: 1x COM (1x RS 232 / 422 / 485)
- Graphics interface: 1x DisplayPort
- Industrial Ethernet interface : 2x Ethernet (RJ45)



Add on modules in IoT2050

- 2Nos of RS485 slave modules with feature like
 - 2 Nos of Analog Inputs
 - 2 Nos of Digital Inputs and 2 Nos of Digital Outputs
 - RS485 port with modbus in 9 pin D connector
- 1No of RS232 module with feature like
 - 2 Nos Analog Inputs
 - 2 Nos of Digital Inputs and 2 Nos of Digital Outputs
 - RS232 port in 9 pin D Connector
- 1 No of LoRaWAN Coordinator
- 1 No of Zigbee Coordinator
- All the above integrated in a single panel.
- External Wireless Sensor Interface Modules

One Wi-Fi End Device with sensor

- API or AT command configuration
- 4 Channel ADC for connecting sensors with 10 bit resolution
- 802.11 b/g/n standard
- 1Mbps data rate
- Up to 309mA Transmit current
- Power supply : Battery/External 5V
- Analog input range : 0 to 1.25V(Max)
- Sensor : Temperature

One Zigbee End Device with sensor

- API or AT command configuration
- 4 Channel ADC for connecting sensors with 10 bit resolution
- 802.15.4 protocol
- 250Kbps data rate
- 35mA Transmit current
- Power supply : Battery/External 5V
- Analog input range : 0 to 1.25V(Max)
- Sensor : LDR



One LoRaWAN End Device with sensor

- * LoRa WAN is a media access control (MAC) protocol for WAN
- * LoRaWAN uses lower radio frequencies with 8 longer ranges
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- * Sensor : Temperature

NOTE:

One computer with Windows Operating System and wired Internet Communication without firewall protection is required for demonstration

4. AM335X Based Beaglebone Wireless Gateway.

- 1 GHz ARM Cortex A8
- 512 MB DDR3 RAM
- 4GB 8 Bit onboard Flash
- 4 x USB 2.0 host
- 3D Graphics Accelerator
- Wi-fi 802.11b/g/n/ 2.4 GHz and Bluetooth 4.1 LE
- OS Compatibility : Debian , android ,ubuntu etc.,

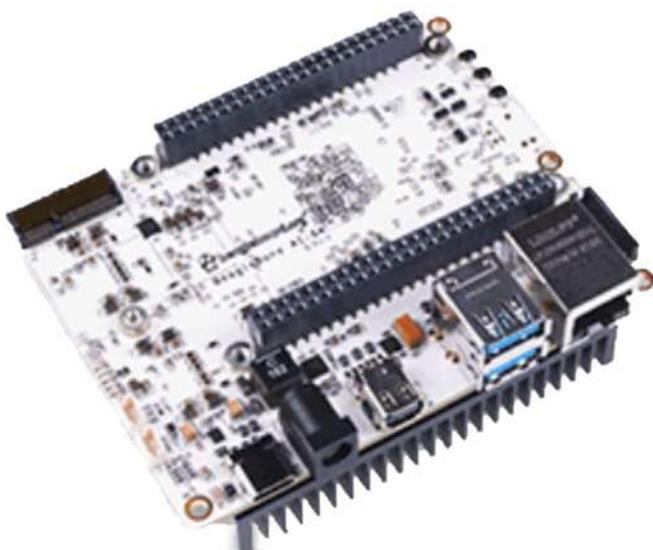


Note: Wi-Fi Router should be provided by the institution to use this as gateway.

5. BeagleBone, 22 Core AI-64 Based Gateway

BeagleBone AI-64 brings a complete system for developing artificial intelligence (AI) and machine learning solutions with the convenience and expandability of the BeagleBone® platform and the peripherals on board to get started right away learning and building applications, including an IOT GATEWAY.

- * Based on powerful TI TDA4VM Processor
- * Dual Arm® Cortex®-A72 microprocessor subsystem @ 2GHz
- * C7x+MMA (8 TOPS) and 2 C66x floating-point VLIW DSPs
- * 3x dual Arm® Cortex®-R5 co-processors
- * 2x 6-core Programmable Real-Time Unit and Industrial Communication Sub System (PRU-ICSSG)
- * Power VR® Rogue™ 8XE GE8430 3D GPU
- * Accelerated video codecs (2x 1080p30 H.264 encode, 8x 1080p30 H.264/H.265 decode)
- * BeagleBone Black header compatibility
- * 4GB RAM and 16GB on-board eMMC flash with high-speed interface
- * USB type-C for power and superspeed dual-role controller; and 2x USB superspeed type-A hosts
- * Gigabit Ethernet, M.2 E-key for Wi-Fi/BT expansion
- * miniDisplay Port, 2x 4-lane CSI, DSI
- * Debian GNU/Linux
- * Based on Jacinto™ 7 architecture, targeted at ADAS and Autonomous Vehicle (AV) applications



ii. Embedded Controllers with Wireless Connectivity

6. STM32U5, Cortex M33 Based Multi Wireless Sensor Board

This kit provides a complete demonstration and development platform for the STM32U585AI, Cortex M33 Microcontroller, featuring an Arm® Cortex®-M33 core with Arm® TrustZone, mainline security extension, 2 Mbytes of Flash memory and 786 Kbytes of SRAM, as well as smart peripheral resources. It includes Wi-Fi® and Bluetooth® modules, as well as microphones, temperature and humidity, magnetometer, accelerometer and gyroscope, pressure, time-of-flight, and gesture-detection sensors. The support for ARDUINO® Uno V3, STMod+, and Pmod™ connectivity provides unlimited expansion capabilities

1. Arm® Cortex® M33 core
2. 802.11 b/g/n compliant Wi Fi® module from MXCHIP
3. Bluetooth® Low Energy from STMicroelectronics
4. MEMS sensors from STMicroelectronics
5. 2 digital microphones
6. Relative humidity and temperature sensor
7. 3-axis magnetometer
8. 3D accelerometer and 3D gyroscope
9. Pressure sensor, 260-1260 hPa absolute digital output barometer
10. Time-of-flight and gesture-detection sensor
11. Ambient-light sensor

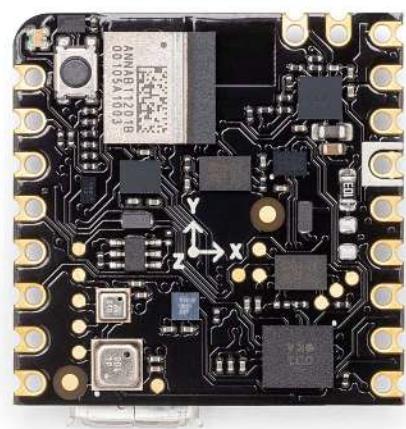


7. Edge Bosch Multisensor Board

The Edge Multisensor Board is a tiny, low-power, Bluetooth tool that sets a new standard for intelligent sensing solutions.

Bring smart sensing solutions to the edge, with the high-performance, low-power board that packs state-of-the-art Bosch Sensortec technology into our smallest form factor.

- BHI260AP motion sensor system with integrated AI
- BMM150 magnetometer
- BMP390 pressure sensor
- BME688 4-in-1 gas sensor with AI and integrated high-linearity, as well as high-accuracy pressure, humidity and temperature sensors.
- Low power consumption
- Add sensing capabilities to existing projects
- When battery-powered, becomes a complete standalone board
- Powerful processor, capable of hosting intelligence on the Edge
- Measures motion and environmental parameters
- Robust hardware including industrial-grade sensors with embedded AI
- BLE connectivity maximizes compatibility with professional and consumer equipment
- 24/7 always-on sensor data processing at ultra-low power consumption



8. Nordic Thingy:53 Multisensor Board

The Nordic Thingy:53 is a rapid prototyping platform, based on the nRF5340 System-on-Chip (SoC), dual-core wireless SoC. With integrated sensors for motion, sound, light and environmental factors, it is the perfect platform for building proof-of-concepts and developing new prototypes in a very short time.

It can handle heavy computational tasks of embedded machine learning, without affecting the wireless connectivity.

1. Arm® Dual Core Cortex® M33 core
2. Bluetooth LE/Bluetooth mesh/NFC/ Thread/Zigbee/2.4 GHz proprietary
3. Bluetooth® Low Energy
4. MEMS sensors
5. Digital microphones
6. Relative humidity and temperature sensor
7. 3-axis magnetometer
8. 3D accelerometer and 3D gyroscope
9. Pressure sensor
10. Color and light sensor



The Nordic Thingy:53 is an easy-to-use IoT prototyping platform. It makes it possible to create prototypes and proofs-of-concept without building custom Board.

9. ARDUINO MKR 1300 LORaWAN Node

- Microcontroller: SAMD21 Cortex-M0+ 32bit low power ARM
- Supported Batteries: 2x AA or AAA
- 4 Digital Input, 2 Digital Output & 2 optoisolated Relay Outputs
- 2 PWM outputs
- UART, SPI & I2C, Interface with termination
- 4 Analog Input
- One Analog Output
- Flash Memory: 256KB
- SRAM: 32KB,
- Clock Speed: 32.768kHz (RTC), 48MHz
- Full-Speed USB Device and embedded Host
- Based on Murata LoRa Module
- Carrier frequency : 433/868/915 MHz
- Antenna Power : 2db
- Semtech LoRa Chipset
- provide plenty of flexibility for connecting sensors, switches and status LEDs



10. ARDUINO MKR 1010 Wi Fi Node

Features

- Digital I/O Pins: 8
- PWM Pins: 12
- Flash Memory: 256 KB
- SRAM: 32 KB
- Microcontroller: SAMD21 Cortex-M0+ 32-bit low-power ARM MCU
- Board Power Supply (USB/VIN): 5V
- Full-speed USB device and embedded host
- Pre-mounted headers with pin-out
- ESP32 Wi-Fi Module



11. Arduino UNO with Wi-Fi

Features

- ATmega328 microcontroller
- Input voltage - 7-12V
- 14 Digital I/O Pins (6 PWM outputs)
- 6 Analog Inputs
- 32k Flash Memory
- 16MHz Clock Speed
- Wi-Fi Module



12. ESP 32 Carrier Board (ESP32#ACC1)

ESP32 Development board on the ESP WROOM32 WIFI +BLE Module it's a low -footprint minimal system development board powered by the latest ESP-WROOM-32 module and can be easily inserted into a solderless breadboard. It contains the entire basic support circuitry for the ESP-WROOM-32, including the USB-URAT bridge, reset – and boot-mode button , LDO regulator and a micro-USB connector. Every important GPIO is available to the developer.

Carrier Board Devices

- LM 35 sensor 1 no
- LDR sensor 1 no
- two nos of LED LED
- Two nos of Micro switch
- Buzzer 1 no
- I2C Based OLED 1 no
- Two nos of PWM termination connector
- one no of SPI Termination Connector r
- Four nos of GPIO Termination connector
- Two nos of DAC Termination connector
- Two nos of ADC Termination connector



13a. ZigBee Sensor Node

Features

- Powerful SoC for 2.4GHz Zigbee applications
- ARM Cortex M3 MCU with 32KB RAM & 512KB Flash
- Connector for sensor interfaces.
- JTAG connector for downloading/debugging.
- Can be operated Battery/External Power adapter

Note: Institution should be purchase minimum 2nos

13b. JTAG debugger for ZigBee RF Card

Features

- USB Bus Powered
- Support USB 2.0 (480Mbps)
- Support target with 20pin (or) 14 pin JTAG
- Support smart RF flash programmer 2
- USB A to Mini B cable included

14. RP2040 Based Multi Sensor Wireless Node (Tiny-40) :

This kit provides a complete demonstration and development platform for the RP2040, Cortex M0+, Dual core Microcontroller, featuring an Arm® Cortex®-M0+, Dual Core, 2 Mbytes of Flash memory and 264 Kbytes of SRAM, as well as smart peripheral resources. Its PIO offers 8 Independent Processor for many IOT Applications.

Tiny-40 includes Wi-Fi and Bluetooth® modules, as well as microphones, temperature and humidity, magnetometer, accelerometer and gyroscope, pressure, time-of-flight, and gesture-detection sensors. The Dual Core, 133Mhz, 8 State Machines can handle heavy computational tasks of embedded machine learning, without affecting the wireless connectivity

The support for ARDUINO® Uno V3, and Pmod™ connectivity provides unlimited HW expansion capabilities.

1. Arm® Cortex M0+ Dual Core
2. 802.11 b/g/n compliant Wi Fi® module
3. Bluetooth® Low Energy
4. MEMS sensors
5. 2 digital microphones
6. Relative humidity and temperature sensor
7. 3-axis magnetometer
8. 3D accelerometer and 3D gyroscope
9. Pressure sensor, 260-1260 hPa absolute digital output barometer
10. Ambient-light sensor
11. ARDUINO® Uno V3 and Pmod Interface.

iii. SENSORS MODULES

15. SENSOR MODULES FOR ALL THE WIRELESS NODES

Basic Sensors Modules

The combination of several Sensors under one solution is called sensor fusion, the best way of achieve high-precision results

i) Force Sensor

- Sensor : FSR400
- Analog output : 0 - 3.3V
- O/P voltage proportional to the force supply to the sensor

ii) Temperature Sensor

- Sensor : LM35
- Precision Temperature Sensor Calibrated directly in Celsius
- Rated for full +2° to +150°C range

iii) Magnetic Sensor

- Sensor : A 1324
- Linear output hall effect such as displacement, angular position & current measurement
- Output voltage proportional to magnetic flux density

iv) Vibration Sensor

- Sensor : Mini sense100
- High voltage sensitivity : 1 V/g
- Over 5 V/g resonance
- Upto 40 Hz operation below resonance

v) Humidity Sensor

- Sensor : HIH4030
- Near linear voltage output Vs %RH
- Typical 1 to 3.6 Volt DC output for 0 to 100% RH at 5V DC supply

vi) RH & Temperature Sensor

- High accuracy Temperature sensor
- Precision relative Humidity Sensor
- 0 to 100% RH operating range
- -40 to 125°C operating range
- Suitable for automotive climate control and defogging micro environment data centre.

vii) Light Sensor

- Sensor : LDR
- Analog output : 0 - 3.3V
- It detects any light source
- Wide Spectral response

viii) 3 Axis Accelerometer

- Sensor : ADXL346
- It measures the static acceleration of gravity in tilt sensing applications
- Digital output resolution - 10 bit
- It detects x,y,z axis of the object
- Selectable Sensitivity ($\pm 2g/\pm 4g/\pm 8g/\pm 16g$)

ix) Smoke Sensor

- Sensor : MQ-II
- Good sensitivity to Combustible gas in wide range
- High sensitivity to LPG, Propane and Hydrogen
- Analog Output

x) Motion Sensor

- Sensor : AMN2311
- Pyroelectric sensor modules contain the necessary functions in a small package (TO-5)
- Ideal for small-movement detection

xi) Tilt Sensor

- Sensor: SFH7710
- Digital output
- Angle 70 to 200 degree gives high output
- Angle 250 to 20 degree gives low output

xii) Ultrasonic Sensors

- Distance Measurement
- Not more than 15 degrees
- Precision upto 2mm
- Output : Electrical frequency

xiii) Pressure Sensor

- I2C Interface
- Wide barometric pressure range
- Pressure range
- 3.3V operating range
- Factory calibrated

xiv) Speed sensor (MOC7811)

- Sensor: MOC7811
- Slotted couplers consist of an infrared emitting diode facing a photo detector in a molded
- Plastic housing

xv) Touch Sensor

- 2 wire serial Interface
- 8 keys or 16 keys mode
- Capacitive touch key
- Operating Voltage 3.3V

xvi) Ultrasonic Sensor (Obstacle Detector)

The module is capable of providing information of the objects between the distance range of 250 mm to 4500 mm. The great advantage of using this Waterproof Ultrasonic Obstacle Sensor is you can put the sensing element far away from all the control circuitry.

Specification

- Integrated with wire enclosed waterproof probe, suitable for wet, harsh measurement occasions
- Small size, easy to use
- Operating Voltage: 5 V
- Sonar Sensing Range: 25-450 cm
- Max. Sensing Range: 450 cm
- Frequency: 40 KHz



NOTE:

THE CUSTOMER CAN ORDER MORE NUMBER OF SENSORS ADDITIONALLY WITH RESPECT TO THEIR REQUIREMENTS

16. Special Sensors Module

i) Digital Humidity Sensor (HTU21D)

The HTU21D sensor is a self-contained humidity and temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 1.5V to 3.6V, has selectable resolution, low battery detect, and checksum capability. The HTU21D has a low power standby mode for power-sensitive applications.

- Measures relative humidity from 0% to 100%
- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Selectable resolution 8-12 bit resolution for humidity; 11-14 bit resolution for temperature)
- Very low power consumption



ii) Digital Pressure Sensor (MS5637)

The MS5637 sensor is a self-contained pressure and temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 1.5V to 3.6V. The sensor module includes a high-linearity pressure sensor and an ultra-low power 24 bit Σ ADC with internal factory-calibrated coefficients.

- Measures pressure from 300 mbar to 1200 mbar
- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Very low power consumption



iii) Digital Temperature Sensor (TSYS01)

The Temperature System Sensor (TSYS01) series is a self-contained temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 2.2V to 3.6V. The TSYS01 has a low power stand-by mode for power-sensitive applications.

- Operating pressure range: 300 to 1200 mbar
- Measures relative humidity from 0% to 100%
- Measures temperature from -40°C to 125°C
- Extended pressure range 10 to 2000 mbar
- Fast response time
- I2C communication
- Very low power consumption



iv) Digital Humidity and Pressure Sensor (MS8607)

The MS8607 sensor is a self-contained pressure, humidity and temperature sensor that is fully calibrated during manufacturing. This sensor can operate from 1.5V to 3.6V. The MS8607 is ideal for weather station applications embedded into compact devices and any applications in which pressure, humidity and temperature monitoring is required.

- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Very low power consumption
- 24/16 bit resolution for temperature



v. ¾ inch Solinoid Valve

Specification

- SKU : AG.DR.1398992
- Type of Product: Irrigation Valve
- Sub Type: Inline
- Size: ¾"
- Material: Plastic
- Series: PGA
- Operating Temperature: 43°C (100°F)
- Operating Pressure: 15 To 150 PSI
(1,0 To 10,4 Bar)
- Flow Range Without PRS-D: 2 to 150 GPM
(0,5 to 34 m3/h; 0,13 to 9,44 l/s)
- Flow With PRS-D: 5 to 150 GPM
(1 to 34 m3/h; 0,32 to 9,44 l/s)
- Frequency: 50-60 Hz
- Inrush Current: 0.41 Amp
- Holding Current: 0.14 Amp

- Coil Resistance: 30-39 Ohms
- Valve Inlet: NPT Female
- Valve Outlet: NPT Female Threaded
- Dimensions: 25.4 (H) x 19.7 (L) x 12.7 (W) cm
- Power Supply Voltage: 24V AC
- Model No: 200PGA



vi. 1 inch Solinoid Valve

Specification

- Type of Product: Irrigation Valve
- Sub Type: Inline
- Size: 1"
- Material: Plastic
- Series: PGA
- Operating Temperature: 43°C (100°F)
- Operating Pressure: 15 To 150 PSI (1,0 To 10,4 Bar)
- Flow Range Without PRS-D: 2 to 150 GPM (0,5 to 34 m3/h; 0,13 to 9,44 l/s)

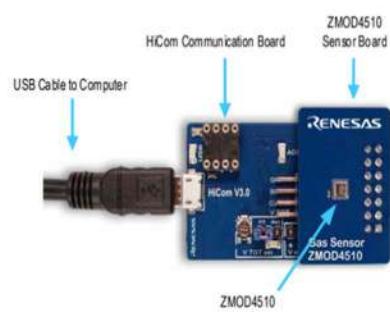
- Flow With PRS-D: 5 to 150 GPM (1 to 34 m³/h; 0,32 to 9,44 l/s)
- Frequency: 50-60 Hz
- Inrush Current: 0.41 Amp
- Holding Current: 0.14 Amp
- Coil Resistance: 30-39 Ohms
- Valve Inlet: NPT Female
- Valve Outlet: NPT Female Threaded
- Dimensions: 25.4 (H) x 19.7 (L) x 12.7 (W) cm
- Power Supply Voltage: 24V AC



17. Advanced sensors module

i) Total Outdoor Air Quality Sensor

- Make : Renesas, Model : ZMOD4510
- for the detection of trace atmospheric gases, including nitrogen oxides (NOx) and ozone (O3) and reporting an Air Quality Index (AQI)
- Measurement of outdoor air quality, including ppb trace gas concentrations of nitrogen oxides (NOx) and ozone (O3)
- Supports international standards for total outdoor air quality
- USB Interface



ii) AmbiMate Sensor Module MS4 Series

AmbiMate sensor module MS4 series provides an application specific set of sensors by integrating the MS4 series pre-engineered, four core sensor solution for Motion / Light / Temperature / Humidity into your next product. This sensor modules include VOC (Volatile Organic Compound), eCO₂ (equivalent carbon dioxide) and sound detection. Add the capability to monitor air quality through the capture of VOC concentrations and with a microphone to augment motion detection or to listen for sound events.

- Make : TE Connectivity (TE) Model : AmbiMate SENSOR MODULE MS4 SERIES
- Sense Capability
- Motion (PIR)
- Light
- Temperature
- Humidity
- VOC
- eCO₂
- Sound (microphone) Applications
- Indoor Lighting, Building Automation
- Connected Home, Air Quality, Energy Management
- Work Space Comfort, Zonal Environmental Controls



iii) Omron Environment Sensor

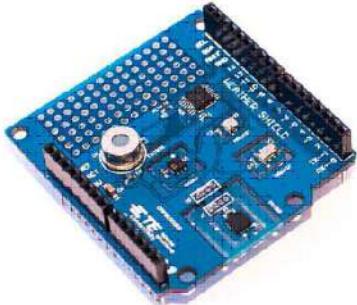
Omron's environment sensor is a multi-function sensing component capable of tracking eight different environmental factors which include: temperature, humidity, light, UV index, barometric pressure, noise, acceleration and VOC (Volatile Organic Compounds) with wireless communication functionality in an ultra-small footprint.



Portable battery-operated type that can be used in your choice of location

iv) Meas Weather Measurement Iot Kit interface with Arduino

The MEAS weather shield for ARDUINO / Raspberry Pi mother board provides the necessary hardware to interface the HTU21D digital relative humidity sensor; MS5637 digital barometric pressure sensor; temperature system sensor (TYS01); MS8607 digital relative humidity and digital pressure sensor; TSD305-1C55 digital thermopile sensor, all from TE Connectivity (TE) to any system that utilizes ARDUINO/ Raspberry Pi mother board compatible expansion ports configurable for I2C communication.



a. Digital Humidity Sensor (HTU21D)

The HTU21D sensor is a self-contained humidity and temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 1.5V to 3.6V, has selectable resolution, low battery detect, and checksum capability. The HTU21D has a low power stand-by mode for power-sensitive applications.

Specification

- Measures relative humidity from 0% to 100%
- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Selectable resolution 8-12 bit resolution for humidity; 11-14 bit resolution for temperature)
- Very low power consumption

b. Digital Pressure Sensor(MS5637)

The MS5637 sensor is a self-contained pressure and temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 1.5V to 3.6V. The sensor module includes a high-linearity pressure sensor and an ultra-low power 24 bit Σ ADC with internal factory-calibrated coefficients.

Specification

- Measures pressure from 300 mbar to 1200 mbar
- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Very low power consumption

c. Digital Temperature Sensor (TYS01)

The Temperature System Sensor (TYS01) series is a self-contained temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 2.2V to 3.6V. The TYS01 has a low power stand-by mode for power-sensitive applications.

Specification

- Operating pressure range: 300 to 1200 mbar
- Measures relative humidity from 0% to 100%
- Measures temperature from -40°C to 125°C
- Extended pressure range 10 to 2000 mbar
- Fast response time
- I2C communication
- Very low power consumption

d. Digital Humidity and Pressure Sensor (MS8607)

The MS8607 sensor is a self-contained pressure, humidity and temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 1.5V to 3.6V. The MS8607 is ideal for weatherstation applications embedded into compact devices and any applications in which pressure, humidity and temperature monitoring is required.

Specification

- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Very low power consumption
- 24/16 bit resolution for temperature

e. Digital Thermopile Sensor (TSD305-1C55)

The TSD305-1C55 is a contactless temperature measurement system located in a TO5 package. The TSD includes an infrared sensor(thermopile) and a sensor signal conditioner.

Specification

- Measures temperature from 0°C to 100°C
- I2C communication
- Contactless temperature measurement
- Fully calibrated
- Up to $\pm 1^\circ\text{C}$ accuracy
- Operating Temperature Range: -10°C ... +85°C
- Low current consumption

v) Meas Weather Measurement IoT Kit interface with Raspberry pi

The MEAS Pi weather hat provides the necessary hardware to interface the HTU21D digital relative humidity sensor; MS5637 digital barometric pressure sensor; temperature system sensor (TSYS)01 digital temperature sensor; TSD305-1C55 digital thermopile sensor to any system that utilizes Raspberry Pi compatible expansion ports configurable for I2C communication.



a. Digital Humidity Sensor (HTU21D)

The HTU21D sensor is a self-contained humidity and temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 1.5V to 3.6V, has selectable resolution, low battery detect, and checksum capability. The HTU21D has a low power stand-by mode for power-sensitive applications.

Specification

- Measures relative humidity from 0% to 100%
- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Selectable resolution 8-12 bit resolution for humidity; 11-14 bit resolution for temperature)
- Very low power consumption

b. Digital Pressure

The MS5637 sensor is a self-contained pressure and temperature sensor that is fully calibrated during manufacturing. The sensor module includes a high-linearity pressure sensor and an ultra-low power 24 bit Σ ADC with internal factory-calibrated coefficients.

Specification

- Measures pressure from 300 mbar to 1200 mbar
- Measures temperature from -40°C to 125°C
- I2C communication
- Fully calibrated
- Fast response time
- Very low power consumption

c. Digital Temperature Sensor (TSYS01)

The Temperature System Sensor (TSYS01) series is a self-contained temperature sensor that is fully calibrated during manufacturing. The sensor can operate from 2.2V to 3.6V. The TSYS01 has a low power stand-by mode for power-sensitive applications.

Specification

- Operating pressure range: 300 to 1200 mbar
- Measures relative humidity from 0% to 100%
- Measures temperature from -40°C to 125°C
- Extended pressure range 10 to 2000 mbar
- Fast response time
- I2C communication
- Very low power consumption

d. Digital Thermopile Sensor(TSD305-1C55)

The TSD305-1C55 is a contactless temperature measurement system located in a TO5 package. The TSD includes an infrared sensor (thermopile) and a sensor signal conditioner.

Specification

- Measures temperature from 0°C to 100°C
- I2C communication
- Contactless temperature measurement
- Fully calibrated
- Up to $\pm 1^\circ\text{C}$ accuracy
- Operating Temperature Range: -10°C ... +85°C
- Low current consumption

vi) PIR Motion Detectors for Indoor

- 5800PIR Motion Detectors (Honneywell)
- 7'-9' mounting height means fewer restrictions than current offerings
- Range: 5800PIR-RES = 35' x 40' (11m x 12m)
- Detection Method: Dual Element Passive Infrared
- RF Frequency: 345 MHz



Vii) Motion Detectors for outdoor

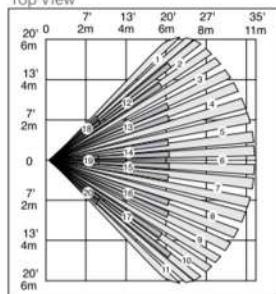
Wireless Outdoor Motion Sensor (5800PIR-OD)



- Provides superior protection for pool areas, rooftops, exits, entrances, car lots, cellular sites.
 - Weather-proof (IP54 rated) and water-resistant (honeywell make)
 - Range adjustable up to 40 feet (12.192 meters) with a 90° adjustable pattern
 - Provides false alarm immunity to pets, small animals and other outdoor disturbances
- 5800PIR-COM RANGE = 60' x 80' (18m x 26m)

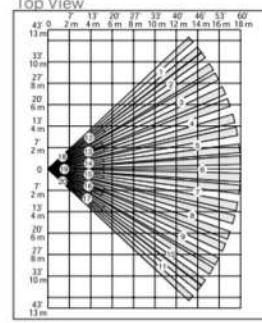
5800PIR/5800PIR-RES Top View

Top View



5800PIR-COM Top View

Top View



18. APPLICATIONS BASED IOT TRAINERS

i. HOME AUTOMATION IOT TRAINER

- a.Omrán Bluetooth based Home Automation sensors (Temperature, Humidity, Light, UV, Barometric pressure sensor and microphone)
- b. 6 Relay Output for connecting light, fan, contactors for AC, Fridge with Wifi connection

ii. LoRaWAN BASED ENERGY MONITORING & CONTROL IOT TRAINER

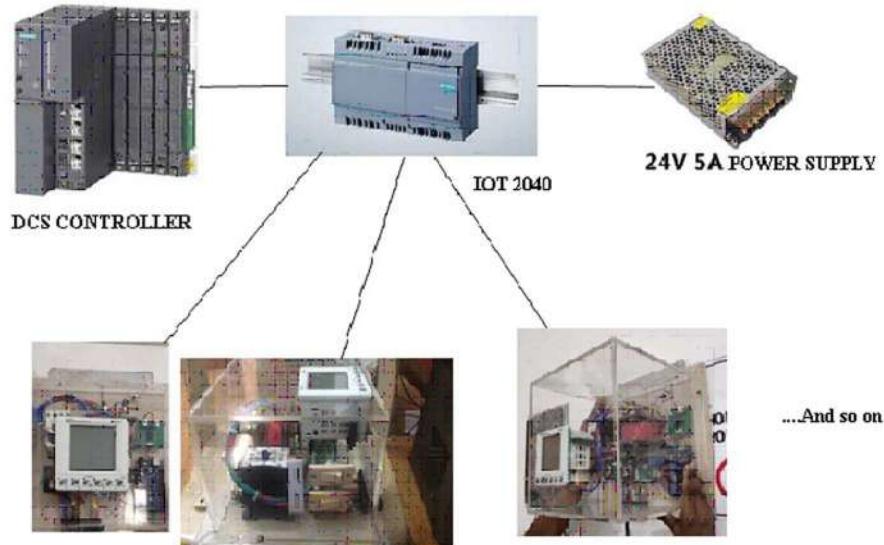
This System Consists of a Energy Meter, LoRaWAN wireless module and 1No of 40A Contactor to power a Single phase line of a Block or Room in a Building. This is specifically designed to interface with IOT2040 Gateway, which in turn connected to a Siemens PCS7-DCS Automation System to demonstrate Energy Monitoring and Control.

The detailed specification as follows

- LoRaWAN Module for Remote Operation for more than 1km
- Arduino Micro controller for Local Monitoring.
- 40Amp Contactor provided.
- Energy Meter with RS 485 Communication
- 50/5A current sensor.
- The current to continuously Monitored & Transmitted through Lorawan to Remote
- Gateway for Cloud Operation.
- The Remote Cloud will monitor the energy consumption and send the remote command to switch ON/OFF the power line for better energy management.



The following figure shows the Energy Monitoring and control for Multiple Building or one Floor or Block



Note: For each additional Energy monitoring and Control Subsystems

10. AGRICULTURE IRRIGATION SYSTEM IOT TRAINER

This IoT based application is based on a IoT Gateway and LoRaWAN based subsystem to control solenoid valves remotely to switch ON/OFF the water supplying to water to trip or sprinkler system for watering plants. Since the power may be a problem at remote places a MPPT based Solar power Generation with 2x6 Volt battery provided to power the solenoid valves.

SOLAR BASED SOLENOID CONTROL

- MPPT Based Solar Powered Dc-Dc Convertor to Charge
- 12 Volts Battery which Power the Solenoid Values
- One Moisture Sensor to Monitor the Soil condition
- 4 Nos of 12 volt Solenoid Valve to Control the Water Flow
- LoRaWAN Module to Control the Solenoid Valve remotely
- LoRaWAN can be connected (1km) to a remote IoT Gateway which in turn connected to a cloud server or a private server



iii. Load Cell Sensor with LoRaWAN IOT Trainer

This module consists of an Embedded controller with LoRaWAN wireless connectivity, 5Kg load cell Sensor, Weights and LCD Digital indicator to display the load.

i) Embedded Controller

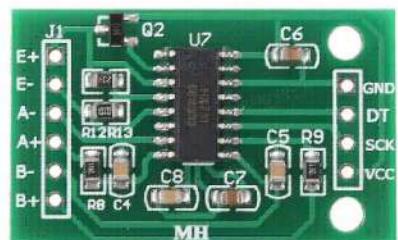
- Microcontroller: SAMD21 Cortex-M0+ 32bit low power ARM
- Supported Batteries: 2x AA or AAA
- 4 Digital Input, 2 Digital Output & 2 Opto isolated Relay Outputs
- 2 PWM outputs
- UART, SPI & I2C, Interface with termination
- 4 Analog Input
- One Analog Output
- Flash Memory: 256KB
- SRAM: 32KB,
- Clock Speed: 32.768kHz (RTC), 48MHz
- Full-Speed USB Device and embedded Host
- Based on Murata LoRa Module
 - Carrier frequency : 433/868/915 MHz
 - Antenna Power : 2db
 - Semtech LoRa Chipset
- provide plenty of flexibility for connecting sensors, switches and status LEDs



ii) HX711 Dual-Channel 24 Bit Precision A/D

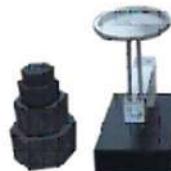
Specification

- Output Sensitivity: $1.0 \pm 0.1 \text{ mV / V}$.
- Two selectable differential input channels.
- On-chip active low noise PGA with the selectable gain of 32, 64 and 128.
- On-chip oscillator requiring no external component with optional external crystal.
- On-chip power-on-reset.
- Measurement Resolution: 24 bit.



iii) Strain gauge based load cell sensor of 5Kg capacity

- A pan provision for placing the standard weights



iv. INTELLIGENT SWITCH GEAR IOT TRAINER

The new generation of circuit breaker from Siemens 3VA1 and 3VA2 family offers many unique features like Intelligent Power Distribution, Communicative capable with SCADA, DCS, Integrated Measuring Functions & etc, Remote Motorized Control

This Trainer uses a 3VA2 MCCB with addition of many add on, facilitates the students to conduct many experiments on this new technology. It consists of

- i. 3VA2, 63A, MCCB
- ii. COM60 communication module
- iii. Microprocessor Trip Unit iv. integrated acquisition of current, voltage and energy values
- v. External Display DSP 800 with many Protocol options vi Remote Motorized Control
- vii. 30KW Three Phase Resistive load

Advanced features:

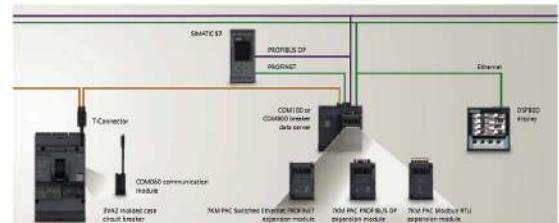
- One 63Amp MCCB (3VA20) with microprocessor Trip unit
- 3VA2 MCCB could very well used in the process and automation industries, in Industrial Buildings etc.
- Communication capable 3VA2 MCCBs are suitable for a variety of applications.
- Can retrieve all information about MCCB directly at your smart phone via QR Code.
- Can identify potential energy savings.
- It can reliably reports
- System status
- Measured values through ETU series to PLC /SCADA /PCS 7 DCS software.
- Manual Rotary operators with illumination kit or motor operator.
- Tripping characteristics can be set via ETU.
- Both setting Parameters and the measured values clearly visible on the display.
- 3VA2 has integrated acquisition of current, voltage and energy values using ETU 8 series.
- The Circuit breaker status (ON, OFF, TRIP) and limit values are also acquired.
- 3VA2 MCCB measure power consumption and support load management,
 - * Useful for keeping a close watch of the Switch Gear Implementation.
 - * 3 VA2 can be connected to higher level power management via Profinet.
- One Residual current Device (RCD) provided.
- EFB300 external function box for connecting to ETU
- Integrated measuring value display
- Measuring function: Voltage, current & energy values.
- Communication capable PROFINET / MODBUS RTU
- RCD continuously detect fault and differential currents and ensure disconnection in the event of emergency.
- Com 060 connection module is mounted on the right-hand side of 3VA2
 - # It establish the connection to the 3VA2 MCCB Via T-connectors.
 - # This is used to transmit measured Data to Com 100



- Com 100 Data Concentrator:
 - # Can monitor one 3VA2 MCCBs.
 - # For connecting 3VA2 MCCB Breakers to standard PLC/DCS Systems.
 - # It collects Data from these MCCBs.
 - # Integrated Ethernet Interface.
 - # 7KM PAC switched Ethernet PROFINET to connect to Simatic PLC: S7-1200 by means of plug – in to com 100
- One External Display DSP 800
 - # For displaying status, measured values and parameters
 - # Connection to com100 Breaker data server via Ethernet.

Unique features

- 3VA2 MCCB with open interfaces and standard protocols (PROFIBUS, PROFINET, Modbus TCP, Modbus RTU), 3VA2 molded case circuit breakers can be seamlessly integrated into an existing technical infrastructure and automation environment, ensuring that the processes in your plant will always be transparent.
- 3VA2 molded case circuit breakers provide specific information about your system's capacity utilization and status, providing perfect plant monitoring and maximum system availability.
- 3VA2 molded case circuit breakers constantly record consumption values and indicate where power usage by individual loads is disproportionately high.
The result: targeted energy and cost efficiency.
- The integrated measuring function allows the 3VA2 molded case circuit breakers to prevent costly plant downtimes and mechanical damage.
- 3VA2 molded case circuit breakers provide a complete overview of all energy-relevant data.
- This ensures end-to-end monitoring, evaluation, documentation, and control.



30KW Three Phase Resistive load

- Rotary switch provided to vary the load for continuous loading upto 40Amps
- For voltage and current sensing to 3VA2 MCCB and used to experiment the TRIP action of the 3VA2 MCCB
- 20 tapping for setting the current
- 415Volt AC Input



v. ITRON WATER FLOW METER WITH LoRaWAN IOT TRAINER

Highly accurate over a widerange of flow rates, ensuring proper measurement of actual consumption. SMART METERING SOLUTIONS allow communication through a large range of advanced and reliable data collection solutions (AMR & AMI), along with a rich dataset.

- Make : Floster, 1inch Pipe, Model : Aquadis+
- Range : $\frac{3}{4}$ to 50 gpm Aquadis+ is a smart metering ready, making it possible to mount a Plug and play LoRaWAN communicating Module at any time.



19. Other specific purpose IOT Trainers

i.Arduino- ESP32- Sensors IOT Trainer (Viot -RA3)

A True IoT kit based on Arduino, ESP32 & Raspberry Pi 4 (as IoT Gateway) with i/o devices like Servo Motor, push button LED, 5V DC Relay, Mini Bread Board, one16x2 LCD Display, one Graphic OLED Display, IR Sensor, LM35 Temperature Sensor with Connecting Wires for students to wire the sensors, switches, etc. to Arduino, Raspberry Pi and also to ESP32 to conduct many experiments.

All components are housed in a wooden Cabinet with a mimic diagram for the students to understand each component of this trainer and conduct many IoT experiments.

On Board Features:

- 1stArduino Uno
- ESP32 as Node MCU with Wi-Fi and 1st Bluetooth.
- 10 nos of LED
- 4 nos of Push Buttons
- DC Servomotor
- 5V DC Relay
- Mini Bread Board
- 16x2 LCD Display
- Ultrasonic Sensor
- LM35 Temperature Sensor
- Infrared Sensor
- Additional on-board features
 - # Graphical OLED Display
 - # PIR Motion Sensor
 - # Potentiometer
 - # 2nd Bluetooth Module – HC05
 - # Buzzer
 - # RGB Led
 - # Joystick
 - # 7 Segment LED Display
 - # LDR sensor
 - # IOT Gateway solution
 - # One Raspberry Pi 4 as IOT Gateway
 - # 2nd Arduino uno
 - # 22'Monitor Display



All the Components are on a single PCB and housed in a sleek wooden cabinet with necessary power supplies. Even though it is specifically designed for polytechnic syllabus, we have added Raspberry Pi 4, which can act as IOT Gateway and another Arduino Uno so that many low cost shields can be added to both Arduino Uno for conducting many Advanced and Industrial IOT Applications.

Note:

AS per quoted price, Raspberry pi and 2nd Arduino uno not given at the time of delivery.

ii. IOT POLYTECHNIC SYLLABUS BOARD : (VIOT-SB#1)

A IoT kit based on Arduino with i/o devices like Servo Motor, push button, LED, 5V DC Relay, Mini Bread Board, one 16x2 LCD Display, one Graphic OLED Display, IR Sensor, LM35 Temperature Sensor with Connecting Wires for students to wire the sensors, switches, etc. to Arduino and ESP32 to conduct many experiments. All components are housed in a wooden Cabinet with a mimic diagram for the students to understand each component of this trainer and conduct many IoT experiments.



1. Arduino Uno

Features

- ATmega328 microcontroller
- Input voltage - 7-12V
- 14 Digital I/O Pins (6 PWM outputs)
- 6 Analog Inputs
- 32k Flash Memory
- 16MHz Clock Speed



2. ESP32 as Node MCU with Wi-Fi and 1st Bluetooth

Features

- Xtensa® dual-core 32-bit LX6 microprocessor(s)
- CP2102 USB-UART bridge. 4XSPI.2 x
- I²S interfaces.2 x I²C interfaces
- 3 x UART, 1 host (SD/eMMC/SDIO), 34 x
- Programmable GPIOs, 12-bit SAR ADC up to 18 channels
- 2 x 8-bit DAC • 10 x touch sensors



3. 10 nos of LED

Specification

- i) 5mm Red Color
- ii) Lamp Light Emitting Diode
- iii) DC 3V - 5V

4. 4 nos of Push Buttons

Specification

1. Through-hole design.
2. Shaft Shape: Square
3. High operating force (3.0N or 3.6N) suited to automotive equipment requirements

5. DC Servomotor

Features

Operating voltage : 3.0V~7.2V,
Operating speed: 0.12sec/60degree,
Output torque:1.6Kg/cm,



6. 5V DC Relay

Features

- 5 V-5v TTL control signals
- the control pins with pull-down circuit
- Blue KF301 terminal control measure



7. Mini Bread Board

Features

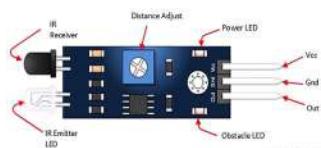
- Matching jumper, diameter 0.8mm
- Accepts 20-29 AWG wire sizes.
- Phosphor bronze nickel plated spring clips



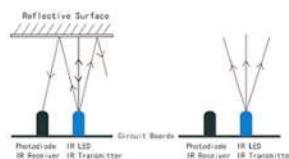
9. Infrared Sensor

Features

- Operating voltage is 5V DC
- I/O pins – 3.3V & 5V
- The range is upto 20 centimeters
- The supply current is 20mA



Working of IR Sensor:



12. OLED

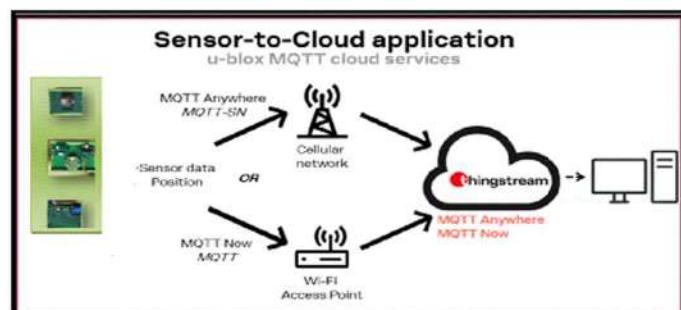
Specifications



- Size : 1.3 inch
- Resolution:128x 64
- Controlling ChiP : SSH1106
- Driving Voltage: 3.3 -5V
- Operating Temperature: -40~70 celsius

iii. Low Cost Arduino- ESP32- Sensors IOT Trainer (Viot-LC)

A True IoT kit based on Arduino & ESP32 with i/o devices like Servo Motor, push button LED, 5V DC Relay, Mini Bread Board, one16x2 LCD Display, IR Sensor, LM35 Temperature Sensor with Connecting Wires for students to wire the sensors, switches, etc. to Arduino and also to ESP32 to conduct many experiments. All components are housed in separate plastic cabinets for the students to understand each component of this trainer and conduct many IoT experiments, by wiring together the modules.



8. 16x2 LCD Display

Features



- 5 x 8 dots includes cursor
- Yellow backlight

10. LM35 Temperature Sensor

Features



- Linear + 10 mV/°C Scale Factor
- 0.5°C Ensure accuracy (at +25°C)

11. Ultrasonic Sensor

Features



- Working Voltage :5V(DC)
- Working Current : 15mA
- Working frequency : 40HZ
- Output: 0-5V
- Beam Angle : Max 15 degree
- Distance : 2cm – 400cm
- Input trigger signal : 10us impulse TTL

13. CONNECTING WIRES

- SP7 PATCH CHORDS

Module 1

- 1 nos of Arduino Uno
- Signals are terminated in Headers
- 16X2 LCD



Module 3

- 8 nos of LED
- 4 nos of Push Buttons
- DC Servomotor
- 5V DC Relay



Arduino Uno

Features

- ATmega328 microcontroller
- Input voltage - 7-12V
- 14 Digital I/O Pins (6 PWM outputs)
- 6 Analog Inputs
- 32k Flash Memory
- 16MHz Clock Speed



ESP32 as Node MCU with Wi-Fi and 1st Bluetooth.

ESP 32 – Wifi+Bluetooth

Features

- * Xtensa® dual-core 32-bit LX6 microprocessor(s)
- * Small volume, easily embedded to other products
- * WiFi and Bluetooth v4.2
- * Strong function with support LWIP Protocol, Free rtos
- * Supporting three modes : AP, STA, and AP+STA
- * Supporting Lua program, easily to develop
- * Includes CP2102 USB-UART bridge
- * 4 x SPI • 2 x I2S • 2 x I2C • 3 x UART • 1 host (SD/eMMC/SDIO)
- * 34 x programmable GPIOs • 12-bit SAR ADC up to 18 channels • 2 x 8-bit DAC • 10 x touch sensors



10 nos of LED

Specification

- 5mm Red Color
- Lamp Light Emitting Diode
- DC 3V - 5V



Module 2

- ESP32 as Node MCU with Wi-Fi and 1st Bluetooth.
- Signals are terminated in Headers



Module 4

- Infrared Sensor
- LM35 Temperature Sensor
- Ultrasonic Sensor
- LDR sensor
- Buzzer



4 nos of Push Buttons

Specification

- Through-hole design.
- Shaft Shape: Square
- High operating force (3.0N or 3.6N) suited to automotive equipment requirements

DC Servomotor

Specification

- High resolution
- Accurate positioning
- Fast control response
- Constant torque throughout the servo travel range
- Excellent holding power



Mini Bread Board

Features

- Use: experimental, testing, robot
- Matching jumper, diameter 0.8mm
- Accepts 20-29 AWG wire sizes.
- Adhesive-backed for permanent mounting.
- Phosphor bronze nickel plated spring clips

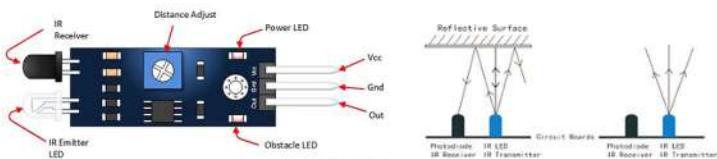


Infrared Sensor

Features

- IR Emitter LED: Emits infrared light
- IR Receiver: A photodiode with resistance depending on the amount of IR
- light falling on it
- Distance Adjuster: Changes detection distance

Working of IR Sensor:



Ultrasonic Sensor

This sensor is a high performance ultrasonic range finder. It is compact and measures an amazingly wide range from 2cm to 4m. This ranger is a perfect for any robotic application, or any other projects requiring accurate ranging information. This sensor can be connected directly to the digital I/O lines of your microcontroller and distance can be measured in time required for travelling of sound signal using simple formula as below. Distance Echo pulse width high time * Sound Velocity(340M/S)/2 or Distance in cm Echo pulse width high time (in uS)*0.017

The module works on 5VDC input and also gives a output signal directly for detection of any obstacle up to 4M.

5V DC Relay

Features



- 5 V-5v TTL control signals
- control DC or AC signal can control the 220V AC load
- the increase in transistor drive a relay coil, control pins high impedance
- the control pins with pull-down circuit, prevent floating relay malfunction
- blue KF301 terminal control measure and easy to wire

16x2 LCD Display

Features



- * 16X2 Character LCD Display Module Blue Backlight.
- * Display Format: 16 Characters x 2 lines
- * 5 x 8 dots includes cursor
- * Yellow backlight
- * The module is a low-power consumption character LCD Module with a built-in controller

LM35 Temperature Sensor

Features



- Based on the semiconductor LM35 temperature sensor
- Useful in detecting ambient air temperature
- Calibrated directly in ° Celsius (Centigrade)
- Linear + 10 mV/°C Scale Factor
- 0.5°C Ensure accuracy (at +25°C)
- Low power consumption, less than 60uA
- Low output impedance, 1mA current through only 0.1Ω Analog voltage output

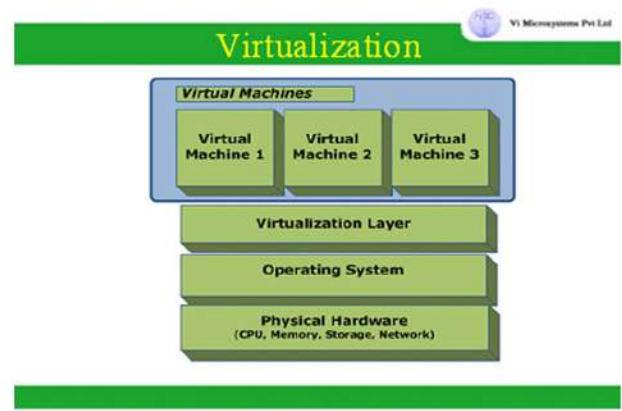
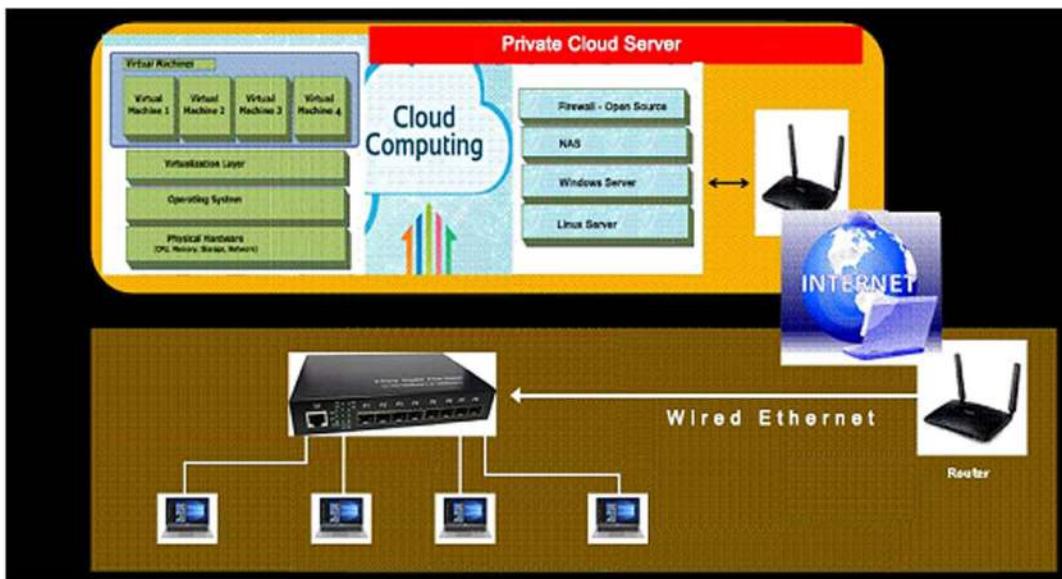
Features

- Working Voltage :5V(DC)
- Working Current : 15mA
- Working frequency : 40HZ
- Output: 0-5V (Output high when obstacle detected in range)
- Beam Angle : Max 15 degree
- Distance : 2cm – 400cm
- Accuracy : 0.3cm
- Input trigger signal : 10us impulse TTL



20. PRIVATE CLOUD SERVER (Viot – Cser-01)

The Computer Hardware can be connected as shown below to conduct all the experiments, related to Cloud Computing like Virtualization, open-source Firewall on a Single Server, Create PaaS, SaaS, Creating VM, allotting resources (CPU core-Memory- HDD) to each VM, loading different OS in each VM, loading software like MySQL, spread sheet for storing sensors data, preparing dash board, etc...



The following equipments needed for this experimental set up

1. Router
2. Manageable switch 2 layer
3. Unmanageable switch.
4. 1 no of i5-12400, 12th Gen 6 cores PC as Linux & Windows Servers with firewall

**(a) i5 -12400, 12th Gen 6 Core
Cloud Server**

Specification

- i5-12400, 12th Gen Processor, 6 Core
- ASUS H610 motherboard, supports Optane memory, VT Enabled, vPro Technology
- 32GB RAM
- 500GB SSD
- 2 x1TB Hard Disk
 - Cabinet with 450W SMPS
 - 22" HDMI Monitor
 - wired Mouse and keyboard
- Windows 11
- Open Source Virtualization Software,
- Open source Firewall.

**(OR) (b) i5 -12600K, 12th Gen 10 Core
Cloud Server**

Specification

- i5-12600K, 12th Gen Processor, 10 Core CPU
- ASUS H660mv5 Motherboard, supports Optane memory, VT Enabled, vPro Technology
- 32GB RAM
- 1TB SSD
- 4 x1TB Hard Disk
 - Cabinet with 450W SMPS
 - 22" HDMI Monitor
 - wired Mouse and keyboard
- Windows 11
- Open Source Virtualization Software,
- Open source Firewall.

NOTE:

The institution should provide the following items at the time of installation.

1. Router
2. Manageable switch 2 layer
3. Unmanageable switch

The following cloud Computing Experiments can be conducted using the above hardware and also can be used for IOT lab as Private Cloud Server

List of Experiments Performed for Cloud Computing

1. To implement program on SaaS to create an word document of your class time table and store locally and on cloud with doc and pdf format
2. To implement program on SaaS to Create a spread sheet to generate a mark sheet for student progress report.
3. To implement web services by create your BlogSpot and Collaborating via Wikis
4. To implement on PaaS to Install Google App Engine, create a program to validate user; create a database login(username, password)in mysql and deploy to cloud.
5. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
6. Install Open Stack and use it as Infrastructure as a Service and use technology own Cloud.
7. Case Study on any one Open source and commercial Cloud-Microsoft Azure , Eucalyptus , Amazon EC2.

List of Experiments performed for IOT Lab.

1. Using Private Cloud, Reading Temperature Sensor Monitoring with Node MCU-ESP32
2. Using Private Cloud, Reading Temperature Sensor Monitoring with NodeMCU /Ardiuno+ESP32
3. Using Private Cloud Reading Temperature Sensor Monitoring with Raspberry Pi 4 as NodeMCU
4. implement and monitor the LM35 Temperature Sensor and Ultrasonic Distance Measurement With Arduino and ESP32 and store in Cloud server
5. implement the IR Sensor Analog Input With Arduino Using Think Speak Cloud
6. Reading Temperature Sensor Monitoring with Node MCU &Raspberry Pi in Private Cloud Server and Think Speak Cloud