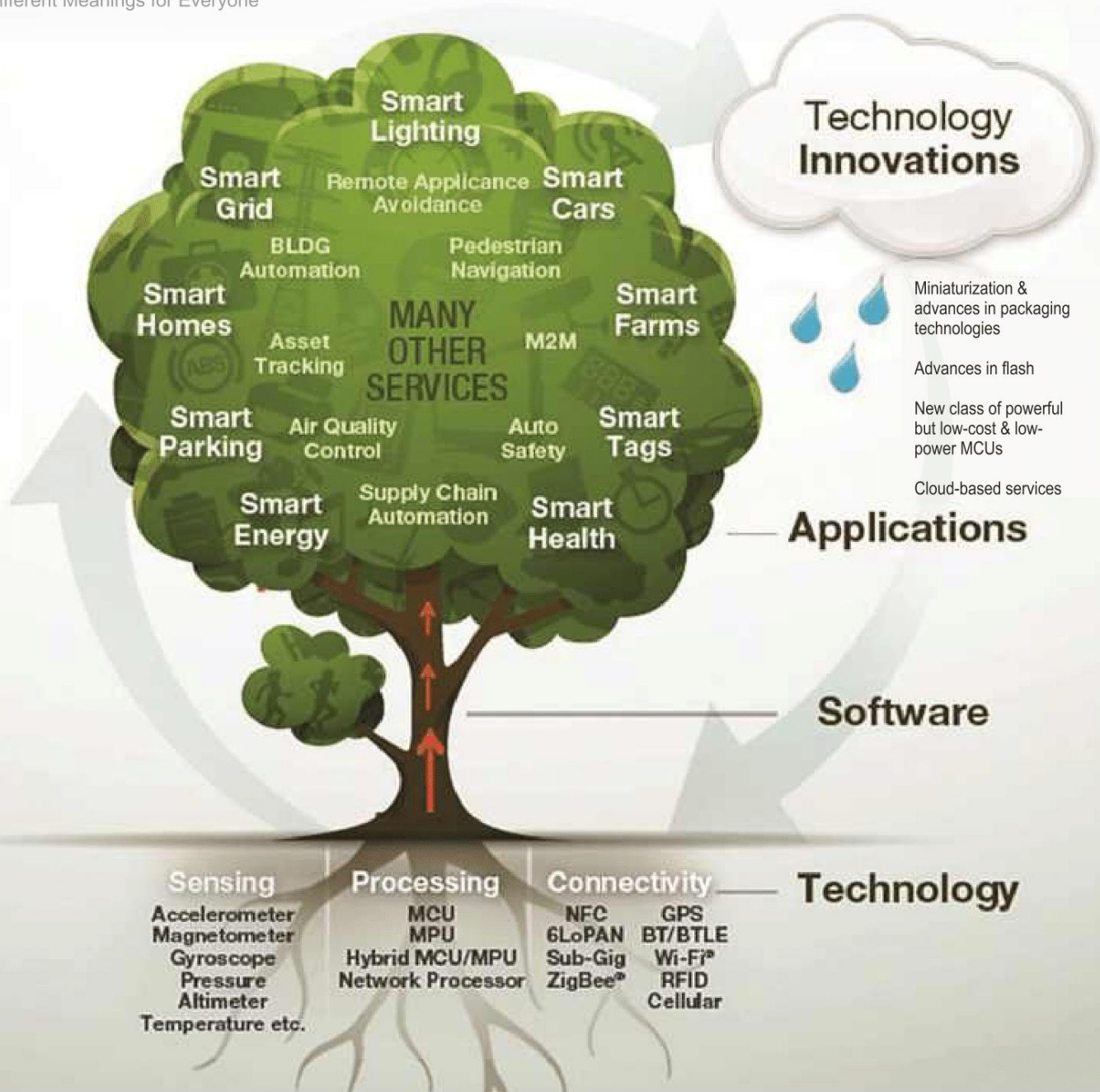


## INTERNET of THINGS

Different Services,  
Different Technologies  
Different Meanings for Everyone



# COURSE DETAILS



## Introduction:

At Gill Instruments we got a simple philosophy “**Sense Connect Manage**” while applying our thought across multiple verticals. Internet of Things (IoT) is a new revolution of the Internet and a hot technology worldwide.

Government, academia, and industry are involved in different aspects of research, implementation and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. A device become a smart device is called IOT.

## What We Do?

Gill Instruments manufacture IoT Gateway. It enables you to connect your sensors and systems on the factory floor to the cloud. You can Monitor and control things using Gill Sense Mobile App. This App can act as your control panel as well as Mobile dashboard, where graphs can generate actionable insights and critical notifications as well.

We can connect following sensors and systems to the cloud using our IoT Gateway.

Sensors: Temperature | Pressure | Humidity | Level | Flow | Speed | Current | Proximity

Systems: Energy Meter | Water Meter | DG Set | Windmill | Elevator | Solar Plant | Motor

## Workshop’s Objective

This program aims at providing an opportunity for participants to enrich their knowledge and skill in developing various solutions for solving engineering problems in the industry. This program serves as a platform for research scholars, faculty, engineers and students to interact on cutting edge technologies in IoT. The Internet of Things (IoT) has evolved from the convergence of wireless technologies, microelectromechanical systems (MEMS) and the Internet. By connecting “things” in the real world such as cars, buildings, and industrial equipment, IoT promises to revolutionize how we live and work.

## Program Outcome:

- Participants will be introduced to exciting real time implementation by Gill Instruments.
- Participants will be trained on Embedded C, implementation of AWS cloud & Android App.
- The training includes hands-on labs resulting in exploration of concepts. (Sense connect Manage).
- Gill Instruments will carry IoT platform kits with software for participants to work on.
- Participants will work in groups of 2 with each student getting an opportunity to work hands-on.
- Upon successful completion of course and test, participants will get a certificate: Endorsed by Texas Instruments and Gill Instruments.

**Eligibility:** The program is designed for faculty of engineering, Research Scholars, students & professionals.

## Agenda:

Duration:	Five days (9: 00 am to 5:00 pm)
Day -One	Introduction & Getting Started with MSP430
Day-Two	Interfacing Sensors with MSP430
Day-Three	Working with MQTT Protocol using Wi-fi module
Day-Four	AWS Cloud services
Day-Five	App Development for Android

The concept of the IoT (Internet of things) has been around for a little while and while it will no doubt deliver a safer and more efficient world, the missing puzzle piece is “intelligence.” For the IoT to fulfill its promise, everything that uses or produces energy in our homes, offices, factories, and transport systems—will need to get smarter and more aware of its environment. This means our appliances will need to understand our priorities and what is required of them—i.e., what kind of clothing the washing machine needs to clean and the type of dirt it must remove, the ambient light conditions and whether someone in a room is reading or watching TV, the charge on a car battery and when the car will be needed, etc. This session will describe the challenges to the smartest, safest, and most efficient Internet of things.

#### Outline

- Building “intelligence” around MSP430
- Choosing the hardware
- Introduction to MSP430
- How to use development tools
- Intelligent sensors (end of non-sense sensor)

New to the MSP430? This is the best place to start. Learn the basics of MSP430 core and the instruction set, addressing modes, unified memory model, and development tools. Exercise your new knowledge with the "starting from a blank screen" lab, where you will enter the few lines of code required to flash LEDs on a demonstration board.

#### Outline

- What is the MSP430?
- MSP430 architecture
- MSP430 CPU, instruction set, and addressing modes
- MSP430 Input /output Port and Interrupts
- Watchdog Timer

Expand your knowledge of the newly enhanced ADC10 peripheral. Witness the new features of the module including an input multiplexer for up to 4/8 channels and the ability for sample-and-hold. You will also learn numerous applications using ADC10 including smart smoke sensors. Real-world examples and demonstrations, including a smoke detector application, will be shown.

#### Outline

- Discussion of the new Applications
- Utility metering
- Portable instrumentation
- Intelligent sensors
- Temperature sensor and reference.

**Real world implementation:** Temperature monitor / Smoke detector application /patient fall detection.

Experience the added performance and flexibility present in the MSP430's newest communication module, USART. The USART features a wide range of communication options for higher-end systems including SPI, I2C, UART/USCI, LIN, and IrDA. Also included is a dual simultaneous communication channel option. See how the USART/USCI module expands communication capabilities and learn which communication bus is best suited to your application. Learn how to save power by using DMA together with USART.

### Outline

- Introduction to USART/USCI
  - o Feature overview
  - o UART/USCI communication modes
  - o Device Selection
- SPI
  - o Modes of communication
  - o Data and clocking options
- I2C
  - o Hardware features
  - o Interrupts and software flow

Explore Timer A, one of the MSP430's most widely used and versatile peripherals. Use this module in ways you may have never previously considered. See how the synchronized capture feature can be used to implement a Tone decoder with very little CPU overhead. Extend the 16-bit range with software to precisely capture and generate longer time intervals with high precision. Generate three independent PWM signals, learn about the timer's trigger capabilities for controlling sample and hold, and see how easily Manchester coding/decoding can be achieved. Leave with the techniques to maximize utilization of Timer A.

### Outline

- Overview of Timer A
- Timer block functionality
  - o Interrupt handling
  - o Extending the 16-bit range
  - o Compare & capture modes
- Generating PWM signals
  - o Multiple output duty cycles from same timer
  - o Adjusting the duty cycle
  - o Mixing PWM with other modes
- Low-overhead UART implementation
  - o Signal & timing considerations
  - o Timer A synchronized latch feature
- Lab: Extended range and using efficient interrupt handling

Protocol	IoT standard protocols	Day-3
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MQTT gives flexibility in communication patterns and acts purely as a pipe for binary data. MQTT has a client/server model, where every sensor is a client and connects to a server, known as a broker, over TCP. MQTT is message oriented. Every message is a discrete chunk of data, opaque to the broker. Every message is published to an address, known as a topic. Clients may subscribe to multiple topics. Every client subscribed to a topic receives every message published to the topic.

#### Outline

- Architecture
- Topic matching
- Application Level QoS
- Last Will and Testament
- Persistence
- Security

IoT Gateway	Connecting to the cloud	Day-3
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An IoT Gateway is a sensor Hub which connects sensors or systems to cloud using your existing Wi-Fi router in home and office. You can monitor and control your smart devices i.e. Water Meter, Gas meter, Smart Street light, and Diesel Generator, Elevator, Temp and humidity for HVAC systems and security systems via smart phones or tablets.

An ultralow power MSP430 is typically used as the host processor which act as a sensor front end and actuator control by providing robust algorithms for signal processing and communication protocols. It also enables the IoT Gateway to manage communications, data processing and applications locally instead of relying on intelligence in the cloud. Additional communications interfaces like blue tooth low energy can also be used to connect with smart phones.

#### Outline

- Application profiles (lighting , Home Automation, Smart Energy)
- Data aggregates from wireless sensor networks
- Bridge between ModBus and Wi-Fi
- WSN to gateway to cloud

MQTT Dashboard & Thingspeak	Visualization of Data and Graph	Day-3
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Using mobile App, you can easily control any MQTT client devices (MSP430 based Hardware) with very simple configuration steps. Within a minute you will be able to make LED on and off by publishing the unique topic on MQTT server using MQTT Dashboard App available from Google play store. Similarly you will be able to display various sensor values i.e. Temperature on mobile by subscribing the same topic which was published by MSP430 based IoT hardware.

ThingSpeak, an IoT platform, enables clients to update a channel feed by publishing messages to the ThingSpeak MQTT broker. MQTT is a publish/subscribe model that runs over TCP/IP sockets or WebSockets. A client device connects to the MQTT broker and can publish to a channel. ThingSpeak supports only publishing to channels using MQTT. Here you will learn how to setup an MQTT client to communicate with the ThingSpeak MQTT broker.

#### Outline

- Set server and port address for Wi-Fi Gateway.
- Subscribe / Publish Topic testing using MQTT Dashboard
- SSID and Password setting for Wi-Fi Gateway.
- Create Dashboard account for Thingspeak.

Amazon Web Services (AWS) is a secure cloud services platform to managed cloud service that lets connected devices easily and securely interact with cloud applications and other devices. AWS IoT Core can support billions of devices and trillions of messages and can process and route those messages to AWS endpoints and to other devices reliably and securely. With AWS IoT Core, your applications can keep track of and communicate with all your devices, all the time, even when they aren't connected.

#### Outline

- Introduction to AWS
- Components of AWS
- Setting up of EC2
- Security Groups and IAM
- Lambda Serverless Computing
- AWS for IOT

Android is an open source mobile operating system that combines and builds upon parts of many different open source projects. What does this mean to you as a developer? You have access to the source code of the platform that is running on the phone. This can help you better understand how interface controls and the various other pieces work. If you happen to find a bug, you can also submit a patch for the issue, though this is a more advanced practice.

This exercise will take you the next level where you can write the code to monitor and control the Internet of things

#### Outline

- Introduction to Android
- Android Architecture
- Activity and Lifecycle
- Layouts
- API's
- Cloud based Authentication
- MQTT setup and demo
- DynamoDB
- Time Series Database