" The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing internet infrastructure. "

Virtual Reality IoT Smart Solutions (Smart Home)   KD-SS 0527

Module 1- IoT Connectivity

Lab1 - Understanding core components of basic IoT building blocks.
Lab2 - Developing a simple mobile app to control devices.
Lab3 - Visualizing the output of IoT remote access with a simple project on IoT connectivity.

Module 2- IoT Remote Sensor Monitoring

Lab 4 - Integration of multiple sensors system
Lab 5 - Monitoring system via IP add/ website real-time
Lab 6 - Project on IoT remote sensor monitoring
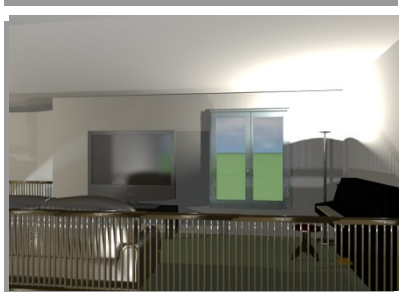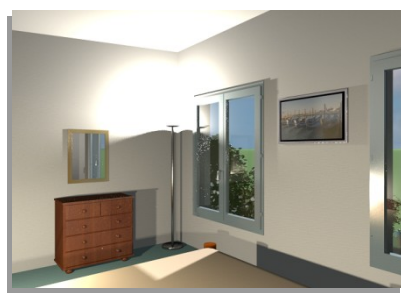
Module 3 – IoT Application

Lab 7 – Virtual Reality IoT Smart Home

Virtual Reality IoT Smart Home Trainer is an interactive all-in-one educational training system that allows you to program, connect, control and simulate IoT systems.

The Internet of Things (IoT) Starts from Home

| Alarm Activation | Lighting Control | Keyless Entry | Remotely Control Appliances | Temperature Monitoring | Graph Plotting | Data Storage |

Virtual Reality IoT Smart Solutions (Smart Home)

Overview

The Trainer "Virtual Reality IoT Smart Solutions (Smart Home)" is an all-in-one interactive educational training software and hardware that allows the user to simulate, program, connect, control and learn Internet of Things (IoT) technology. The system adopts the advantages of virtual reality with multimedia and comprehensive graphical animation. The system is user friendly, safe to be used, and effective. The system replicates what is commonly found in typical IoT system, which comprises Alarm Activation, Lighting Control, Keyless Entry, Remotely Control Appliances, Temperature Monitoring, Data Storage and Graph Plotting.

The Trainer has the following features:

a) Interactivity: Interesting virtual reality multimedia simulation and comprehensive interactive graphical animation
b) Interoperability: Not confined and usable for any type of programmable controller.
c) Setup Space: Compact. All are in one setup.
d) User Friendly: Easy to setup.
e) Safety: No risk to personnel and equipment damage.
f) Effective Learning: Student can easily understand the operation and diagnose the problems to complete the project application.
g) Manual Mode: MANUAL modes are available. Easier to understand with step-by-step operation.
h) Test Flexibility: Switch to REMOTE mode to immediately test and control your systems.
i) Pre-Built Smart Home Applications: The pre-built 3-dimensional scenes are based on what is commonly found. Simulate smart home scene on various selection of typical IoT system, which comprises Alarm Activation, Lighting Control, Keyless Entry, Remotely Control Appliances, Temperature Monitoring, etc.
j) Remote Supervision: Can be supervised via internet network in the class room environment.
k) Learnability: Easier to learn and achieved from low to higher level.
l) Arrangement of module: From simple to complex in accordance to the Bloomfield taxonomy in education.

Technical Specifications

1) The trainer consists of two main modules: **Virtual Reality Software Simulator** and **Hardware Emulator**.

a) Virtual Reality Software Simulator

The virtual reality software simulator comprises virtual reality and multimedia features with comprehensive 3-dimensional smart home graphical animation aided simulation.

The software simulator consists of the following simulation:

a.1) Smart Home Application

1) Manual and Remote Control of Fan and Floor Lamp at Living Room.
2) Manual and Remote Monitoring of Fire Alarm at Kitchen.
3) Manual and Remote Control of Keyless Garage Door
4) Manual and Remote Monitoring of Motion Sensor and Lighting at Home Entrance.
5) Manual and Remote Control of House Appliances (Television and Floor Up-light) at Mezzanine.
6) Manual and Remote Control of Air Conditioning and Light Dimming at Bedroom.
7) Manual and Remote Control of Pool Water Temperature.

The software also consists of five control buttons: QUERIES, MANUAL, REMOTE, RESET, HOME. The *Queries* button will indicate the appliances with the Wi-Fi connectivity. The *Manual* button is to control and monitor the smart home manually. The *Remote* button will interface the smart home to the hardware emulator, to be connected and controlled using Internet. The *Reset* button is to reset both the manual mode and remote mode. Finally, the *Home* button will reset the overall operation.

The software installation requirements are as followings:
  i. Windows Vista or higher
  ii. Intel Core 2 Duo at 2GHz or AMD Athlon 64x2 2GHz or higher
  iii. 1Gb RAM Memory
  iv. 500Mb hard disk space

b) Hardware Emulator

Hardware Emulator is an interfacing unit or an inter-medium between the embedded programmable controller and the software simulator.

The Hardware Emulator is interoperable that is not confined to a single type of embedded programmable controller. It is applicable to many different types and brands of embedded programmable controllers.

The Hardware Emulator is packaged with the followings:

    i.   (9-12)VDC Power Supply
    ii.   Power Indicator Light
    iii.   8 Digital Input Terminals
    iv.   8 Digital Output Terminals
    v.   1 Analogue Input Terminal
    vi.   1 Analogue Output Terminals
    vii.   PC USB Communication Port
    viii.   Embedded Programmable Controller (Arduino Mega)
    ix.   Wi-Fi Router

The embedded programmable controller allows user to connect and control the simulated 3-dimensional smart home IoT systems on computer via the hardware emulator. It is packaged with the followings:

    i.   (9-12)VDC Power Supply
    ii.   Digital I/O (40-54 Points)
    iii.   Digital Outputs (2 Points)
    iv.   Analog Input (16 Points)
    v.   Analog Output (14 Point)
    vi.   Serial Port (4 Points)
    vii.   Bluetooth Master and Slave.
    viii.   Ethernet Module

2) Experiment/Teaching Modules

The training system introduces IoT fundamentals, IoT wire/wireless communications and IoT systems design techniques, leveraging embedded systems focusing on IoT Smart Solutions (Smart Home). Students who complete this course will have an overview of the IoT's architecture, technologies and ecosystem. Students will be able to design and develop an IoT system targeting IoT gateway and sensor network. The training system allows students to develop typical IoT applications with various types of wireless connectivity. Students will be able to perform verification and design validation on these IoT applications.

Module 1 – Introduction to IoT Connectivity
a) Introduction to core components of basic IoT building blocks and architecture.
b) Introduction to enabling technologies for IoT system.
c) Understanding various key wired and wireless technologies used in the IoT systems.
d) Perform system setup, connect between host and target, and test run a simple program using the IoT Development Kit.

Module 2 - Developing an IoT Platform to Control Devices.
a) Introduction to the Peripherals of the IoT Development System.
b) Digital Communication Protocol for IoT
c) Write applications to use I^2C and SPI for communication, and configure digital sensors with interfaces.
d) Develop programs to interface with push button, external mass storage, UART and GPIO.

Module 3 - IoT Remote Access on IoT connectivity.
a) Interfacing to IoT devices.
b) Monitoring system via IP add/ website real-time.
c) Set up the development system to interface with external sensors and actuators, and learn to interface gateway to sensor devices.
d) Visualizing the output results on a PC simulator.

Module 4 – Integration of Wire and Wireless Sensor Networks for IoT
a) Integration of multiple sensors system.
b) Wire Sensor Networks for IoT.
c) Use wireless communication over Bluetooth LE by developing IoT node devices that communicate with each other.

Module 5 – IoT System Design and Development
a) Deployment of IoT sensor node onto cloud and visualize the results on an end user client device for activity monitoring.
b) Cloud-enabled IoT operation.
c) Exploring Cloud Messaging Protocol-Learn to call and use cloud services to connect to the cloud, set up, and test with mobile devices.
d) Designing IoT applications using embedded systems.

Module 6 – IoT Applications
a) Case studies on Smart Home.
b) Development of IoT Smart Home comprises Alarm Activation, Lighting Control, Keyless Entry, Remotely Control Appliances, Temperature Monitoring, Data Storage and Graph Plotting.

System Setup
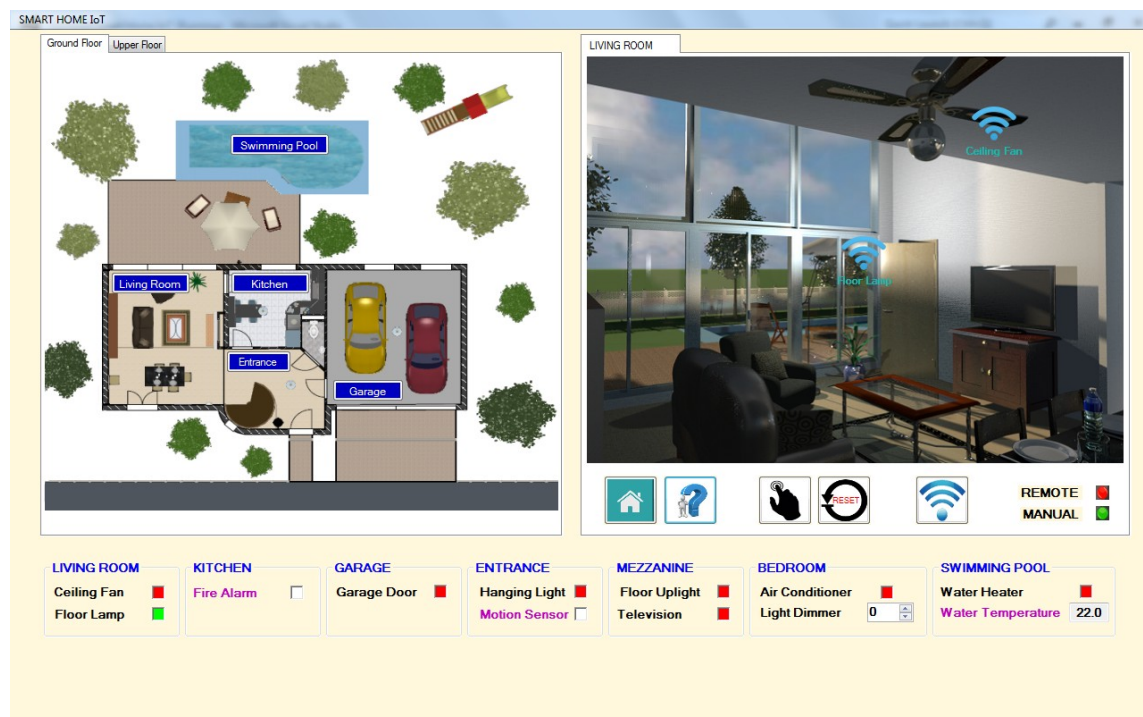
Deliverables

1) Installation software "Virtual Reality IoT Smart Solutions" in compact disc or USB. The software can be operated ONLY when the hardware is connected.
2) Hardware emulator and embedded programmable controller in a suit-case.
3) One year warranty card.
4) PC communication cable.
5) Wires and required accessories.
6) Laboratory manual with complete solutions.
7) Exclude personal computer / laptop.