Industrial-Academia Collaboration
List of Industrial Projects

Project 1: High Frequency High Power SPDT switch

Description: SPDT switches are used commonly in transmission systems for switching between receiver and transmitter path. There are many configurations through which SPDT switches can be made. One such configuration has been shown in Figure 1.

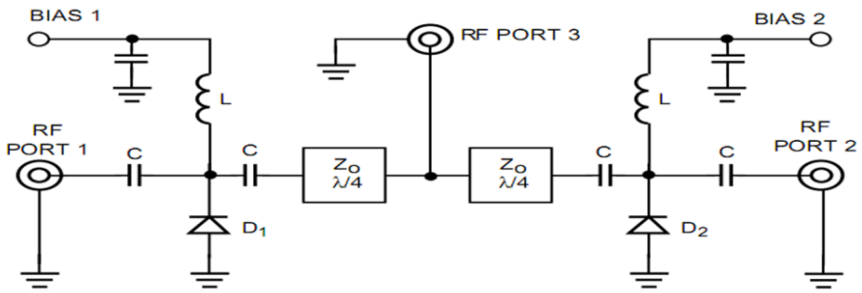

Figure 1: Shunt PIN SPDT Switch configuration.

This configuration is known as Shunt PIN SPDT Switch. In this configuration the diodes are placed in a shunt configuration witch the transmission path. The switch operates as follows: When Diode D_1 is forward biased and Diode D_2 is reverse biased, RF power will flow from Port 3 to Port 2, and Port 1 will be isolated. The λ/4 line will transform the short circuit at D_1 into an open circuit at the common junction, eliminating any reactive loading at that point. Vice-versa when the diode D_2 is forward bias and D_1 is reverse biased.

There are also some other configurations for realizing the SPDT switch which includes Series configuration and series-shunt configuration. The advantage Shunt configuration is its high isolation independent of frequency. The drawback of this configuration is its bandwidth limitation due to usage of λ/4 transmission lines at junction point. Change in frequency from center frequency, f_o will increase the mismatch at junction point. This can be improved by incorporating matching tee at junction point.

Specifications:

Operating frequency	16GHz - 17GHz
Insertion loss	< 1dB
Isolation	> 20dB
Return loss	< 20dB
Power handling	36 dBm
Switching time	10ns

Project 2: Narrow band Ku-band Microstrip band pass filter for high sensitivity Radar receiver application

Specifications:

Center frequency	16.75 GHz
Bandwidth	500 MHz
Pass band frequency (1dB)	16.5 – 17 GHz
Insertion loss	< 5 dB
Type	Microstrip based

Project 3: Millimetre (mm) wave antenna design for future 5G communication systems

Description:

The last ten years have seen a massive growth in the number of connected wireless devices. Billions of devices are connected and managed by wireless networks. At the same time, each device needs a high throughput to support applications such as voice, real-time video, movies, and games. Demands for wireless throughput and the number of wireless devices will always increase. In addition, there is a growing concern about energy consumption of wireless communication systems. Therefore, the future 5G wireless systems have to satisfy three main requirements: i) having a high throughput; ii) simultaneously serving many users; and iii) having less energy consumption supply chain. Multiple input multiple- output (MIMO) proposes utilizing a very high number of antennas to multiplex messages for several devices on each time-frequency resource, focusing the radiated energy toward the intended directions while minimizing intra and inter cell interference can meet the above requirements, and hence, it is a promising candidate technology for future fifth generation wireless communication systems. In this context, the primary focus of the proposed research project is to design a mm-wave MIMO antenna for the 5G communication devices.

Specifications:

Centre frequency	28 dBi
Fractional Bandwidth	$\geq$ 20 %
Isolation	$\geq$ 25 dB
Gain	$\geq$ 7 dBi
Type	Compact and Low-profile

Project 4: Design and Simulation of a High Gain Microstrip Antenna for GPS Applications

Description:

The objective of this project is to design and simulate a high gain microstrip antenna for GPS applications. GPS technology has become ubiquitous in modern society and is used in a wide range of applications, from navigation in vehicles and aircraft to location-based services and more. However, GPS signals are weak and can be easily obscured by environmental factors such as buildings and other structures. The goal of this project is to design an antenna that provides a high gain and improved signal reception for GPS applications.

Specifications:

Frequency Range	1.15-1.6 GHz
Gain	8-10 dBi
VSWR	Less than 2.0
Impedance	50 Ohms
Polarization	Linear
Beamwidth	60 degrees
Dimensions	40mm x 20mm

Project 5: Implementation of a Low-Cost, Short-Range Radio Frequency Identification (RFID) System

Description:

The purpose of this project is to design and implement a low-cost, short-range Radio Frequency Identification (RFID) system for small scale applications. RFID technology has become an integral part of modern supply chain management and inventory control, allowing for real-time tracking of goods and products. The goal of this project is to develop a cost-effective and scalable RFID system that can be used for various small-scale applications such as library management, inventory tracking, and asset management.

The implementation of the RFID system will involve the design and development of both the RFID tags and the RFID reader. The RFID tags will be small and lightweight, allowing for easy integration into a variety of products and packages. The RFID reader will be capable of communicating with multiple RFID tags at once and will be able to transmit data to a central database for real-time tracking and monitoring.

Specifications:

Operating Frequency	2.45 GHz
Communication Range	Up to 3 meters
Read Rate	1 tag per second
Data Capacity	32 bits
Power Supply	USB or battery
Antenna Type	Dipole
RFID Tag Size	40mm x 20mm
RFID Reader Size	70mm x 50mm x 20mm

Project 6: Development of a Smart Home Automation System using Wi-Fi

Description:

The aim of this project is to develop a smart home automation system using Wi-Fi technology. The increasing demand for home automation systems has driven the development of technologies that allow for the control and monitoring of various devices and appliances in the home. A smart home automation system is a network of devices and appliances that can be controlled remotely using a smartphone or other mobile device. The system will be designed to control and monitor various devices and appliances in the home, including lights, air conditioning, heating, and security systems. The system will use Wi-Fi technology to communicate with the devices and appliances and will be controlled through a smartphone or tablet app. The app will allow users to turn devices on and off, set schedules, and monitor energy consumption. The system will also have a user-friendly interface that allows for easy setup and configuration.

One of the main challenges of this project will be to ensure that the system is reliable and secure. The system must be able to handle large amounts of data and must be able to communicate with multiple devices and appliances simultaneously. To ensure security, the system will be designed to use encryption and secure protocols for data transmission. The development of this smart home automation system will be significant in several ways. Firstly, it will provide homeowners with a convenient and cost-effective way to control and monitor their home appliances and systems. Secondly, it will help to increase energy efficiency by allowing users to monitor and control their energy consumption. Finally, the system will provide a platform for the development of new and innovative home automation technologies.

Specifications:

Operating Frequency	2.4 GHz
Communication Range	Up to 30 meters
Data Transfer Rate	Up to 54 Mbps
Power Supply	USB or battery
Operating System	iOS or Android
Supported Devices	Lights, AC, heating, security systems
Encryption	WPA2 or higher
User Interface	Mobile app
Control Options	Remote control and scheduling
Energy Monitoring	Real-time energy consumption monitoring