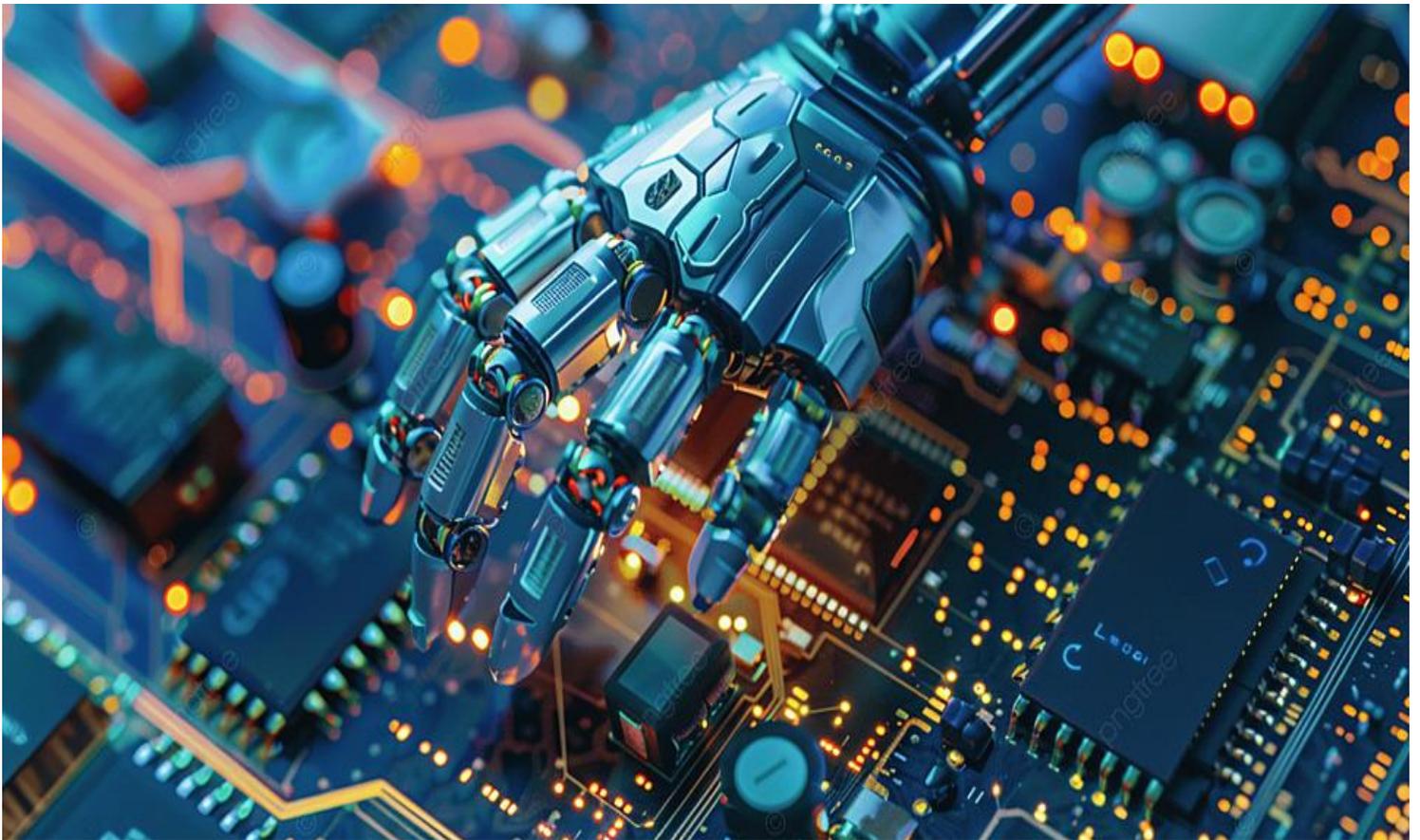


MAGAZINE

JANUARY- DECEMBER 2020

ECE SPECTRUM

Volume 01- (Yearly Technical Magazine)



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ABOUT ECE DEPARTMENT

The Department of Electronics & Communication Engineering aims to impart value-based technical education and train students to become well-rounded engineers. Since its inception in the academic year 2008-09 with an initial intake of 60 students, the department has grown significantly. The current intake of the ECE department is 180 students. The department boasts faculty strength of 53 well-qualified, experienced, and dedicated postgraduates, including 11 doctorates, with some faculty members currently pursuing Ph.D.'s in various streams.

VISION OF THE DEPARTMENT

To be a pioneer in Electronics and Communication Engineering and research, promoting entrepreneurship and delivering innovative solutions to societal needs

MISSION OF THE DEPARTMENT

M1: To provide a strong foundation in Electronics and Communication Engineering, preparing students to tackle emerging technological challenges.

M2: To drive research in Electronics and Communication Engineering that delivers innovative solutions to societal needs.

M3: To promote lifelong learning, empowering students to adapt to the evolving technological advancements

Program Educational Objectives (PEO's):

The following are the Program Educational Objectives (PEO's) for Electronics & Communication Engineering Under-Graduate Program.

PEO 1: Exhibit continuous growth in technical expertise and leadership within the engineering field, while upholding professional ethics.

PEO 2: Communicate effectively and manage resources skillfully as members and leaders of the profession

PEO 3: Commit to continuous learning and adapt to emerging technologies to meet the evolving needs of society.

Program Specific Outcomes (PSOs):

PSO1: Develop electronics and communication systems in VLSI, embedded systems, signal processing, and RF communications using advanced tools.

PSO2: Apply ECE knowledge to design, develop, and test systems, considering societal, environmental, ethical, and economic factors.

Program Outcomes (POs):

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

MESSAGE FROM HOD**Dr. B. Nancharaiah**

Professor & Head of the Department, Department of ECE,

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Dr. B. Nancharaiah received his B.E. degree in Electronics and Communication Engineering in 1999 from SRKR Engineering College, Bhimavaram, affiliated to Andhra University, India. He obtained his M.Tech degree in Electronics and Communication Engineering in 2003 from Pondicherry Engineering College, Pondicherry Central University, India. He earned his Ph.D. degree in Wireless Communications and Networks in 2017 from JNTUH, Hyderabad, India.

Dr.B.Nancharaiah has been working as Professor and HOD in the Department of Electronics and Communication Engineering at Usha Rama College of Engineering and Technology, Telaprolu, Andhra Pradesh, India, since June 2018. With 23 years of teaching experience, he is a Life Member of ISTE and Fellow of IETE. He has published over 70 papers in reputable national and international journals and conferences. He is the author of two textbooks: Metaheuristic Algorithms in Wireless and Mobile Ad Hoc Networks and Antenna and Wave Propagation. His research interests include wireless communications, networks, and IoTs.

Our department is committed to providing quality education and training to our students, enabling them to excel in their chosen careers. We strive to create a stimulating learning environment that fosters innovation, creativity, and critical thinking. Our faculty members are dedicated professionals with expertise in their respective areas, and we are proud of our strong industry partnerships that provide opportunities for internships, projects, and placements.

Best regards,

Dr.B.Nancharaiah

Head, Department of Electronics and Communication Engineering

Message from the Editorial Team

We are excited to present to you the third issue of the ECE Department's Technical Magazine for the academic year 2020-2021. This edition is a reflection of the talent, dedication, and hard work of our students, showcasing their remarkable achievements in both co-curricular and extra-curricular activities.

The primary goal of this magazine is to highlight the innovative projects, research, and technical skills exhibited by our students. We believe that the exchange of knowledge and experiences plays a key role in shaping the future of technology and engineering.

We would like to extend our sincere gratitude to the Management and our esteemed Principal for their unwavering support and encouragement, which have been instrumental in the success of this initiative. We hope this magazine continues to inspire and inform, fostering a spirit of collaboration and innovation within the ECE department.

Chief Editor : Dr. B.Nancharaiah, Professor & HOD.

Faculty Advisors : Dr M.V.Srikanth, Dr.A.Suneel Kumar, Associate Professors.

Student Editors : A. Usha Ramya-II ECE Bhogadi Meghana- II ECE

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1. IoT-Based Patient Health Monitoring System

Abstract:

This project presents an IoT-based patient health monitoring system that measures parameters like temperature, heart rate, and blood pressure using sensors connected to a Wi-Fi-enabled module (ESP8266). Data is stored on a cloud platform for real-time monitoring by doctors through smartphones or web servers. The system is low-cost, low-power, portable, and efficient for remote healthcare monitoring.

Introduction:

Modern healthcare requires continuous patient monitoring, but traditional systems rely heavily on hospital visits and in-person supervision. IoT and wearable sensors integrated with Raspberry Pi enable remote monitoring of vital parameters such as ECG, temperature, and pulse. This approach reduces hospital stays, improves accessibility, and enhances patient care.

Objectives

- Use IoT for remote patient health monitoring.
- Employ Raspberry Pi as the system's core controller.
- Collect key health data (temperature, BP, sugar, heartbeat, etc.).
- Display results on mobile apps, web servers, and via SMS.
- Store patient records in a database for emergency access.
- Provide timely alerts to save lives in emergencies.

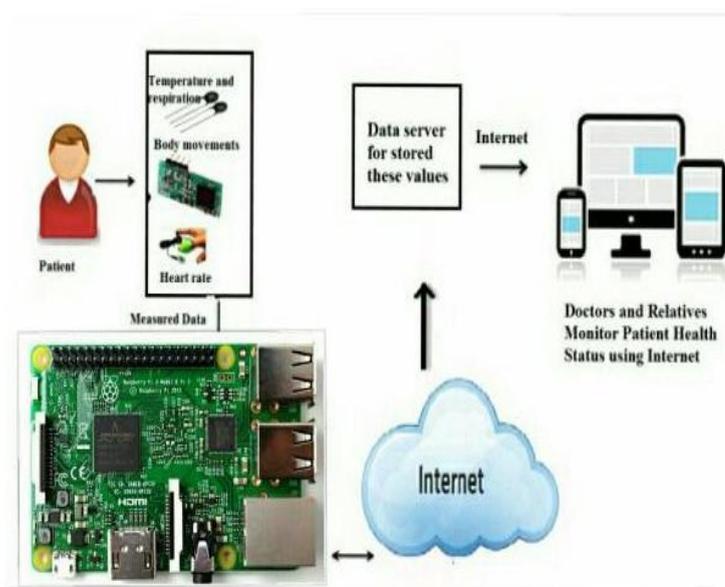
Methodology

The system has two levels:

1. **Patient Level:** Sensors measure ECG, heart rate, temperature, and BP; amplified signals are sent to Raspberry Pi.
2. **User Level:** Raspberry Pi acts as a server, uploads data to the web, and sends SMS alerts if readings are abnormal.

Users can access data globally using IP-based monitoring via smart phones, laptops, or tablets.

Figure:



Hardware Requirements

- Raspberry Pi 2 Model B
- LM35 Temperature Sensor
- Heartbeat & BP Sensor
- ECG Sensor
- MCP3202 ADC
- LCD Display, Alarm, GSM Module, Wi-Fi Dongle

Software Requirements

- Raspbian OS
- Python IDLE
- Thing Speak Server

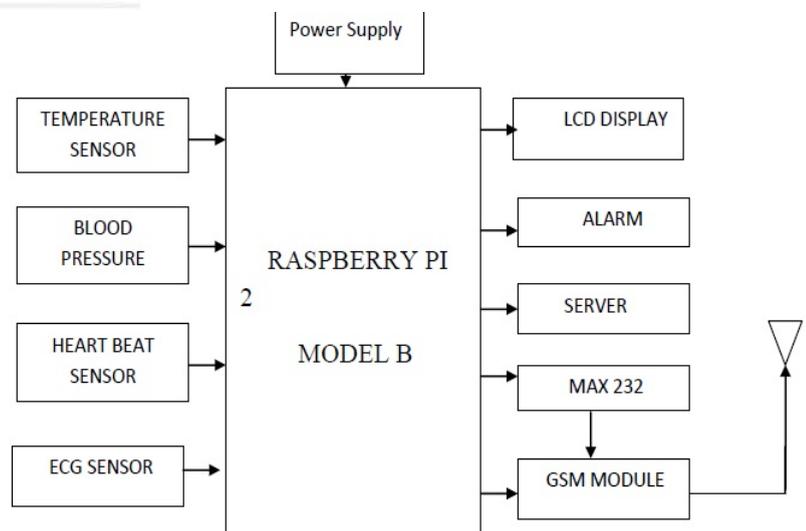


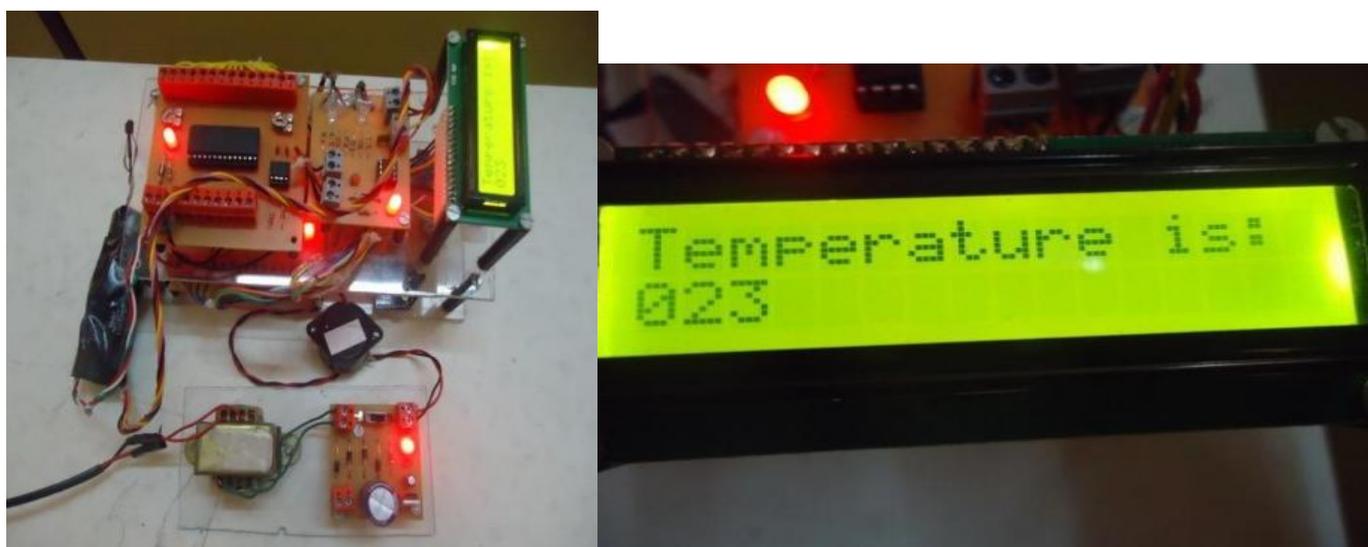
Figure: Block diagram of patient health monitoring system using IOT Devices.

Key Sensor Summaries

- **Temperature Sensor (LM35):** Accurate, linear, calibrated in Celsius, range -55°C to $+150^{\circ}\text{C}$.
- **Heartbeat Sensor:** Uses light modulation and an LM358 IC to detect BPM.

Results

The system automates health monitoring, reducing manual intervention and healthcare costs. Alerts notify doctors in emergencies, and patient data is securely stored online for remote access and analysis.



Future Scope

- Integrate more advanced sensors for additional health metrics.
- Use wireless sensors to reduce wiring.
- Compact design (wearable devices like watches).
- Apply similar technology to industrial and agricultural monitoring.

Conclusion

The IoT-based health monitoring system enables real-time, remote patient supervision, data storage, and alert notifications. Future enhancements aim to increase connectivity, expand sensor integration, and improve portability for broader healthcare applications.

2. Automated Effluent Treatment System for the Coir Industry

Abstract:

This project proposes an automated effluent treatment system for coir industries to purify wastewater generated from retting and soaking processes. Using PLC-based automation, the system provides a simple, affordable, and efficient solution for recycling water, reducing environmental pollution, and promoting sustainable water use in coir production regions like Kerala, India.

Introduction:

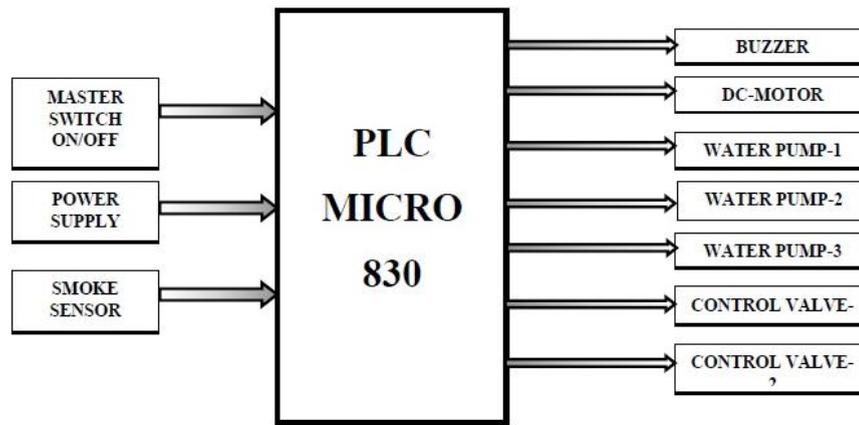
The coir industry, vital for rural employment in India and Sri Lanka, faces environmental concerns due to water pollution from traditional retting methods. With growing demand for eco-friendly products, sustainable wastewater treatment is essential. IoT and automation can improve water recycling, reduce ecological damage, and modernize coir production.

Objective

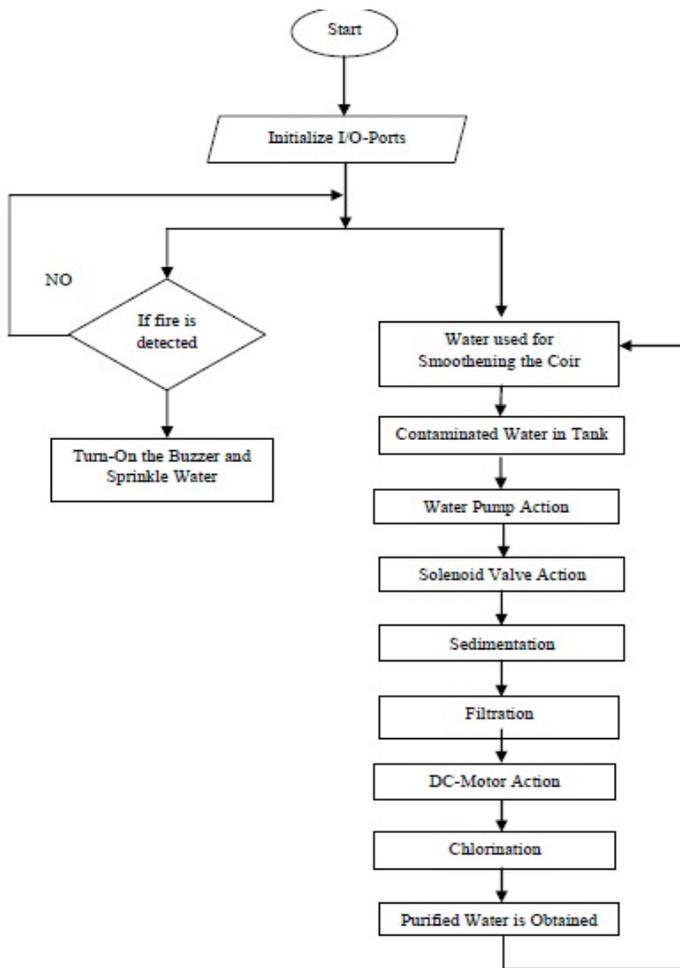
- Automate wastewater treatment for coir industries.
- Reduce water pollution and recycle treated water for industrial or domestic purposes.
- Provide a cost-effective, eco-friendly solution using PLC-controlled automation.

Methodology

- Wastewater stored in reservoirs is pumped through filters to remove macro and micro impurities.
- Chlorination is applied for disinfection.
- PLC (Micro-830) controls solenoid valves, DC motors, and water pumps for automated operation.
- Treated water is delivered to industries or apartments, with the process repeating automatically until stopped manually.



Flow Chart



Key Components

- **Power Supply:** Converts 230V AC to DC for PLC and devices.
- **Master Switch:** Controls the entire system.
- **Smoke Sensor (MQ7):** Detects carbon monoxide for safety monitoring.
- **Buzzer:** Provides fire/smoke alerts.
- **Control Valves (12V Solenoid):** Manage fluid flow.
- **DC Motor (5V):** Operates stirrers for treatment.
- **Water Pump (6V):** Automates water transfer between stages.
- **PLC (Micro-830):** Central controller for automation, sequencing, and optimization.

Result

The prototype demonstrates an efficient PLC-based wastewater treatment system for coir industries. It successfully purifies water, enabling recycling for reuse, and can be adapted for different types of industrial effluents. The model highlights the role of automation in reducing water pollution and conserving resources

Future Scope

- Expand the system for large-scale industries and residential complexes.
- Improve water quality for drinking purposes.
- Integrate IoT for remote monitoring and control.

Conclusion

Despite technological challenges and high R&D costs, automation in effluent treatment offers a sustainable solution for the coir industry. It can reduce pollution, improve worker safety, and support small-scale producers through eco-friendly production methods. Public sector investment and innovation are crucial for scaling this system to benefit rural communities and promote global market competitiveness.

3. Plant to Reuse Water Using Sensor Technology

Abstract:

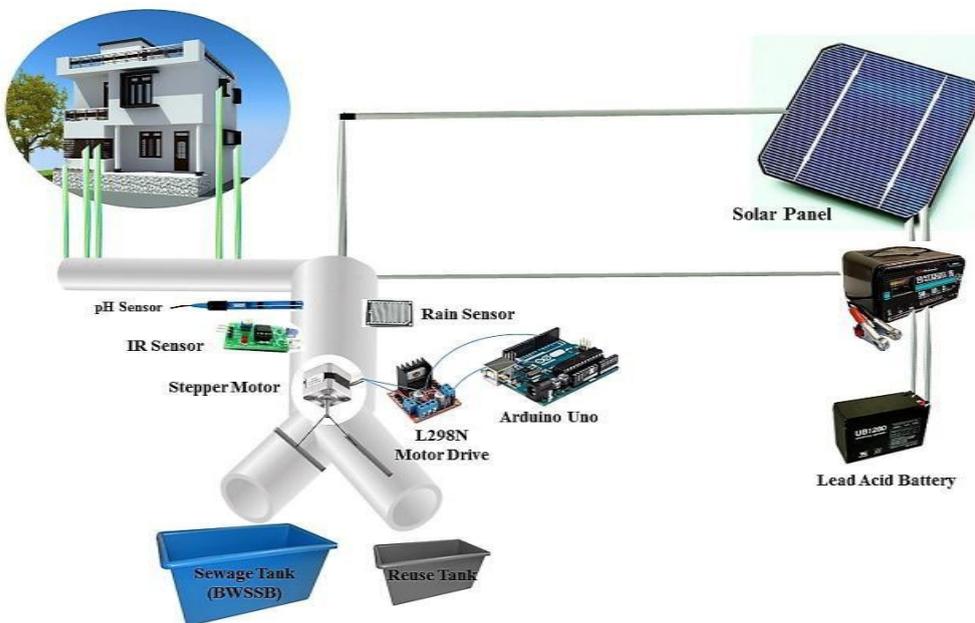
This project aims to develop a cost-effective system to conserve water by recycling domestic wastewater. Using pH and particulate sensors interfaced with an electromechanical setup, the system identifies reusable water and redirects it for suitable household purposes, helping reduce water wastage and promote sustainability.

Introduction:

With increasing global water scarcity, efficient reuse of wastewater is essential. Technologies like IoT, smart sensors, and recycling methods (e.g., RBC tanks) are emerging to monitor and treat greywater. This project integrates sensors and automation to assess and reuse household wastewater economically.

Objectives

- Minimize domestic water wastage
- Recycle water within safe limits
- Reuse treated water for select home uses
- Encourage water reuse practices
- Ensure economic feasibility

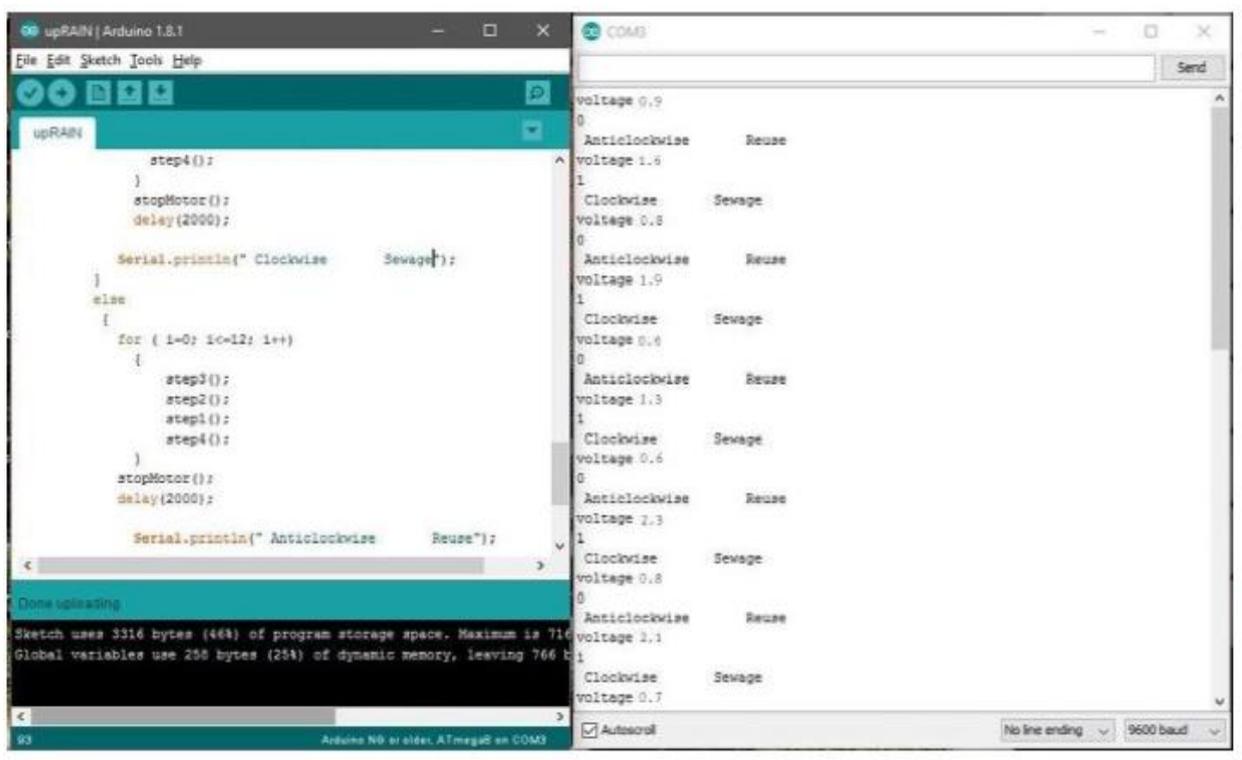


Methodology

1. pH and particulate sensors detect water quality.
2. Arduino-controlled motor diverts reusable water.
3. Wastewater from kitchen, washbasin, and bathroom is processed via a common pipeline.

The system uses pH and particulate sensors to assess household wastewater. If water is within safe limits, a motor-operated valve diverts it to a recycled water sump; otherwise, it's sent to the sewage. Powered by a solar-charged lead-acid battery, the setup is simple but only saves 10–20% of water. It's ideal for new constructions, though it doesn't detect bacteria and requires careful tuning of sensor thresholds. Pipes are angled to reduce water pressure for accurate sensing.

Results



The screenshot shows the Arduino IDE interface. The sketch 'upRAIN' is displayed on the left, and the serial monitor on the right shows the output of the program. The sketch includes a loop that checks for water reuse based on sensor data. The serial monitor shows a sequence of voltage readings and motor control commands.

```
upRAIN | Arduino 1.8.1
File Edit Sketch Tools Help
upRAIN
  step4();
}
stopMotor();
delay(2000);

Serial.println(" Clockwise   Sewage");
}
else
{
  for ( i=0; i<=12; i++)
  {
    step3();
    step2();
    step1();
    step4();
  }
  stopMotor();
  delay(2000);

  Serial.println(" Anticlockwise   Reuse");
}
Done uploading
Sketch uses 3316 bytes (46%) of program storage space. Maximum is 7168 bytes.
Global variables use 256 bytes (25%) of dynamic memory, leaving 766 bytes free.
Arduino N0 or older, ATmega16 on COM3
Autoscroll No line ending 9600 baud
```

Serial Monitor Output:

```
voltage 0.9
0
Anticlockwise   Reuse
voltage 1.6
1
Clockwise   Sewage
voltage 0.8
0
Anticlockwise   Reuse
voltage 1.9
1
Clockwise   Sewage
voltage 0.6
0
Anticlockwise   Reuse
voltage 1.3
1
Clockwise   Sewage
voltage 0.6
0
Anticlockwise   Reuse
voltage 2.3
1
Clockwise   Sewage
voltage 0.8
0
Anticlockwise   Reuse
voltage 1.1
1
Clockwise   Sewage
voltage 0.7
```

The flowing water is tested, and if the pH values are within the permissible limits and there are no particles present, the water flows to the reuse tank as shown in the figure shown above, for the remaining conditions the motor opens the valve to the Sewage tank

Conclusion:

In the present scenario, there is scarcity of fresh water resources. The Water is integrated into every aspect of our lives and it is essential to protect this valuable resource. In this proposed method water can be reused without the usage of any chemicals. By implementing this method, we can make smart utilization of water.

4. Smart Auditorium with Security System

Abstract:

This project focuses on power saving in public places like auditoriums, malls, and theatres by automating control of electrical appliances using an Arduino controller. It includes a metal detector for security at the entrance and a fire alarm system. Power saving is achieved by controlling fan speed based on temperature and guiding audience seating to avoid unnecessary energy use. The system operates efficiently with minimal power consumption.

Introduction:

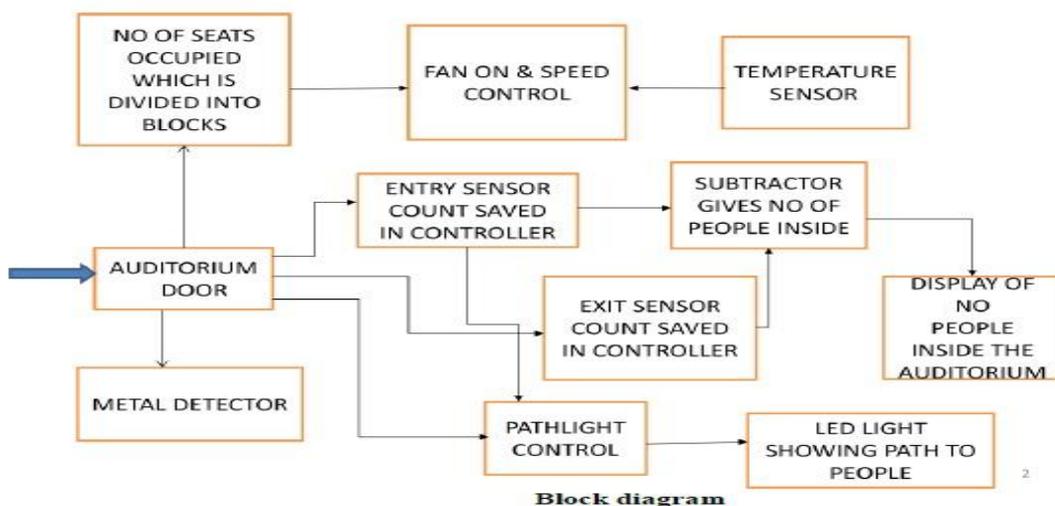
The “Smart Auditorium with Security System” aims to reduce power wastage by automating seating guidance and electrical controls. Sensors at entry and exit count people and activate systems only when needed. Seating rows are filled sequentially with guiding LEDs, and fans are automatically adjusted based on internal temperature. A metal detector ensures entry-level security.

Objective and Methodology

- Count number of people in the auditorium
- Guide people to unoccupied rows from front to back
- Automatically control fans based on temperature
- Use a metal detector for security

The system uses entry and exit sensors to count people and manage seating. Fan speed is adjusted via a temperature sensor, and LEDs guide attendees to seats. The count is shown on an LCD, and a buzzer alerts security when metal is detected.

Block Diagram



RESULT AND ANALYSIS:

Initially when the auditorium was empty, all the fans were OFF and the message “Empty auditorium” was displayed on the LCD. The guiding LEDs were activated and path to the particular row is shown and count is displayed on LCD

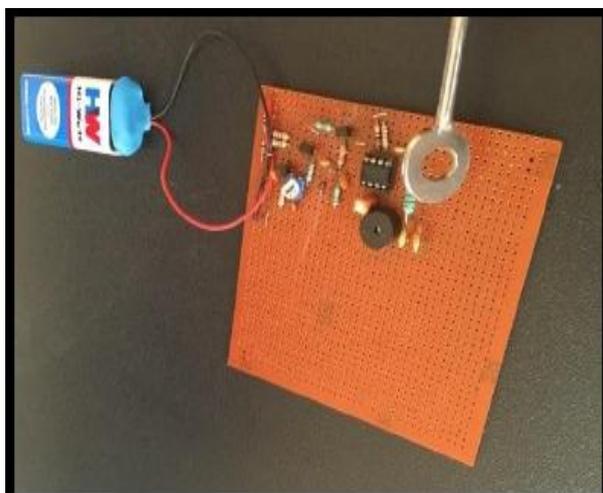


LCD displayer



IR sensor interface

At the same time, the control signal for fan of the first block was activated and fan is turned ON. When the person enters into the second block, the fan corresponding to that block is turned ON. The IR sensor at the entry door activated indicating the entry of person. Similarly exit IR sensor detects for the people who exits from the auditorium. The metal detector is placed at the entry of the auditorium door which works on the principle of colpitt's oscillator (3). The buzzer gets activated if metal is present.



Advantages

- PIR sensors can detect motion from a long distance based on calibration.
- They are compact and easily fit into electronic devices.
- Low cost, low power, durable, and easy to interface.
- Offer multifunctionality by serving multiple purposes with a single device.

Conclusion

The project aims to reduce power wastage in auditoriums by automating fan control and seating guidance using an Arduino controller. Security is ensured with a metal detector at the entrance. The Arduino manages all functions efficiently, requiring a constant power supply for smooth operation.

5. Smart School Van Safety System

Abstract:

School van accidents are rising due to driver negligence, alcohol use, over speeding, and vehicle faults. This system enhances safety by using an alcohol sensor to prevent ignition if the driver is intoxicated, ultrasonic sensors to detect wheel dislocation, and speed monitoring to alert authorities. Built-in GPS and GSM modules notify parents about bus location and arrival, ensuring safer transport for children.

Introduction:

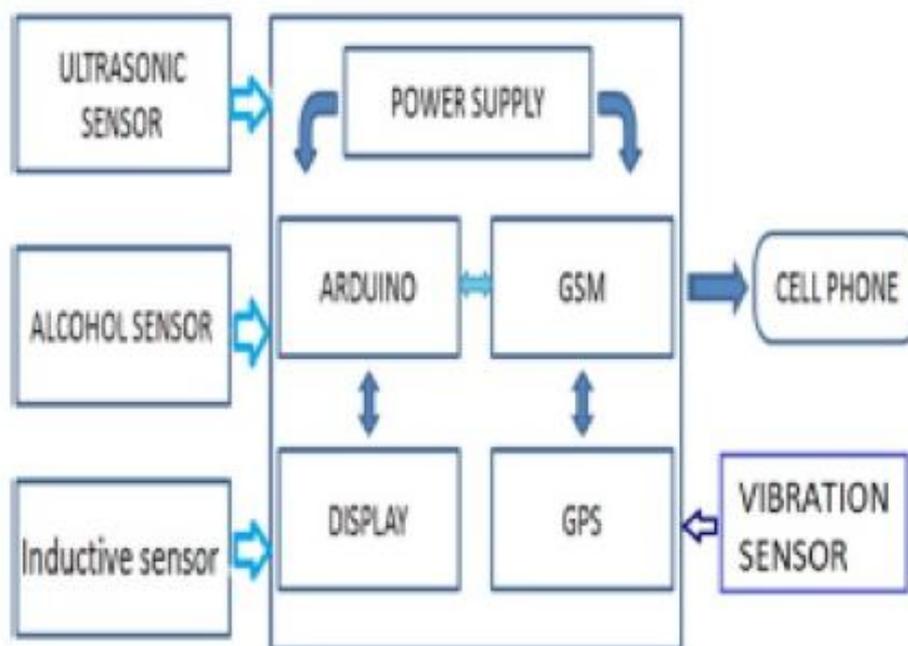
The system tracks student entry/exit using RFID tags and alerts if a child is left on the bus via SMS. It also informs school management of bus departures and arrivals, improving security and efficiency.

Objectives:

To provide a secure, automated safety system for school bus transportation that eases parental concerns and improves child safety.

Methodology:

- **Alcohol Sensor:** Detects driver intoxication and disables ignition.
- **Ultrasonic Sensors:** Monitor wheel position and alert driver if dislocated.
- **Inductive Sensor:** Monitors speed and alerts when limits are exceeded.
- **GPS Module:** Tracks bus location and notifies parents/students of arrival.
- **GSM Module:** Sends alerts and messages to parents, technicians,

Block Diagram:**Results**

The alcohol sensor installed in the bus senses the alcohol content of driver and if it is above the threshold level SMS alert sent to the authority and the ignition will not turn on. Students are able to receive message about the arrival of the bus prior to one stop. The inductive sensor accurately measures the speed of the wheel. Any dislocation in the wheel is detected by the ultrasonic sensor and sends alerting message to the driver. The integration of all these safety systems in the school van leads in total security of school going children and also any parent can extract information about the current status of the bus at any time.

Conclusion:

The Smart School Van Safety System effectively enhances child safety by enabling real-time tracking, speed control, alcohol detection, emergency alerts, and proper student monitoring during school transport.

6. IoT-Based Smart Power Monitoring Socket

Abstract:

This project introduces an IoT-based power monitoring socket designed to measure and track electricity consumption for individual devices. Using IoT technology, each socket connects to the internet, allowing users to monitor power usage remotely via cloud applications. The system aims to reduce electricity wastage by identifying high-consumption devices, enabling smarter energy management at home and in industries.

Introduction:

Energy saving is a global challenge, and IoT provides an innovative way to monitor and control power usage. Smart sockets with IoT connectivity enable real-time data tracking, remote control, and efficient energy management. Unlike traditional systems, this model integrates sensors, controllers, and internet connectivity to optimize power consumption, reduce waste, and improve home automation.

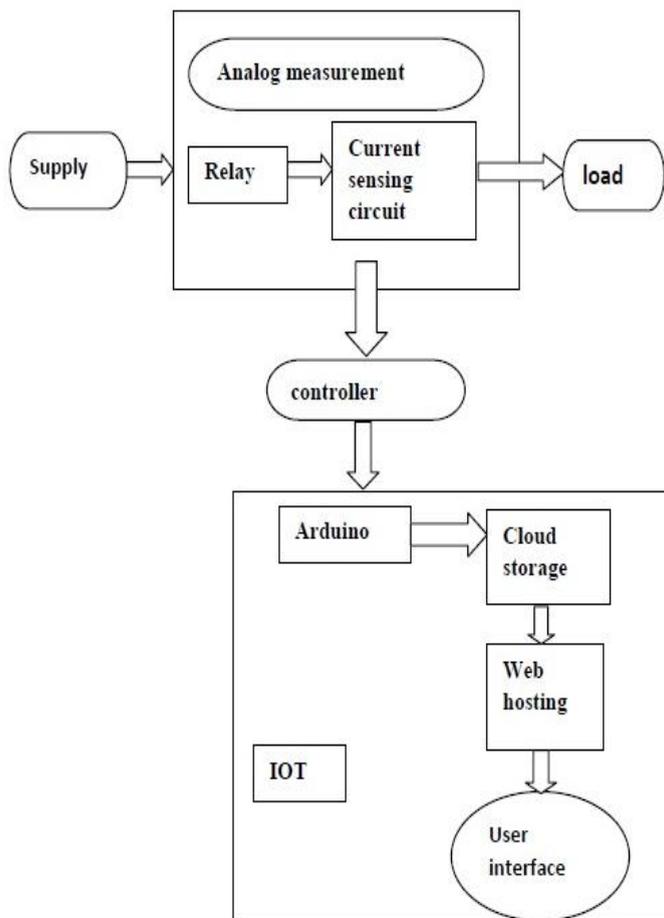
Objectives

- Design smart sockets that display energy usage per socket.
- Connect sockets to the internet for remote monitoring.
- Create a cloud-based application to track and analyze device-wise energy consumption.
- Enable efficient energy management and promote power saving practices.

Methodology

- **Power Measurement:** Use a relay and current sensing circuit to measure device power usage.
- **IoT Integration:** Arduino collects and processes data, then uploads it to the cloud for remote access.
- **Display:** Power data is shown on an LCD display and accessible via mobile devices.

Results



The system successfully measures and displays individual device power consumption, providing practical results that help users manage high-consumption devices efficiently.

Parameter	Single load (60W bulb)	Double load (60W & 25W bulb)
Voltage	230V	230V
Current (I=P/V) (Practical)	0.26A	0.26A, 0.10A
Power (Theoretical)	60W	60W,25W
Power (Practical)	59.8W	59.8W, 24.8W

Future Scope

- Expand IoT networks to connect multiple home appliances.
- Integrate devices like thermostats and wearable for automated adjustments.
- Broaden IoT applications in industries and smart homes, exploring unlimited possibilities.

Conclusion

The proposed IoT-based smart socket enables device-level power monitoring, a feature missing in traditional energy meters. By allowing users to track energy consumption remotely, this system promotes energy conservation and cost efficiency, making homes and industries smarter.

7. Multiband Hybrid for Wi-Fi

Abstract

Wireless communication systems often operate on multiple frequency bands (e.g., Wi-Fi at 2.4 GHz and 5 GHz). This project focuses on designing and analyzing multiband hybrid couplers for RF and microwave applications. Two types of multiband hybrid couplers were simulated and fabricated:

- A branch line multiband coupler covering 2.45 GHz and 5.25 GHz
- A hybrid coupler covering 2.45 GHz, 5.25 GHz, and 5.8 GHz

These couplers use rectangular disk hybrid couplers and open circuit stubs. Additionally, a multiband Butler matrix incorporating these hybrid couplers and Schiffman phase shifters was fabricated for beamforming applications in antenna arrays and multipoint amplifiers.

Project Objective

1. Design a multiband hybrid coupler operating at 2.4–2.485 GHz, 5.15–5.35 GHz, and 5.725–5.85 GHz
2. Design a Butler matrix for multiband antenna systems

Methodology

- Review related literature
- Propose and simulate the coupler structures using CAD software, optimizing dimensions via simulation results
- Fabricate optimized designs and measure S-parameters using a Vector Network Analyzer
- Compare measurements with simulations and refine models for accuracy

Tools Used

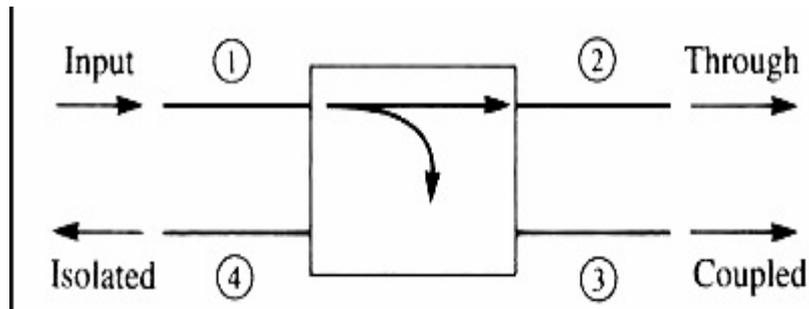
- **CAD Software:** Zeland IE3D for EM simulation, AutoCAD for layouts, Txline for micro strip calculations
- Vector Network Analyzer: Agilent 8753ES for S-parameter measurements

Material

- Dual-band branch line coupler fabricated on substrate with permittivity 2.65, thickness 0.5 mm
- Rectangular disk hybrid, phase shifter, Butler matrix fabricated on substrate with permittivity 2.33, thickness 1.57 mm

Hybrid Coupler Overview

A hybrid coupler is a power divider circuit with equal amplitude outputs. Quadrature 3 dB couplers are common hybrids where outputs have equal amplitude and a 90° phase difference



Hybrid Coupler Parameters

- **Insertion Loss**

$$\text{Insertion Loss} = -20 \log_{10} |S_{21}|$$

Measures power loss from input (port 1) to through port (port 2). Typical range: **3 to 4 dB**.

- **Coupling Factor**

$$\text{Coupling} = -20 \log_{10} |S_{31}|$$

Ratio of input power (port 1) to coupled port output (port 3). Typical range: **3 to 4 dB**.

- **Isolation**

$$\text{Isolation} = -20 \log_{10} |S_{41}|$$

Difference between input port and isolated port (port 4) signals. Should be **greater than 10 dB**.

- **Return Loss**

$$\text{Return Loss} = -20 \log_{10} |S_{11}|$$

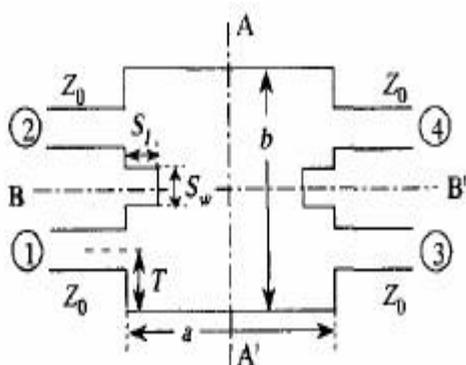
Indicates reflected power at input port. Should be **less than -10 dB** for good matching.

- **Directivity**

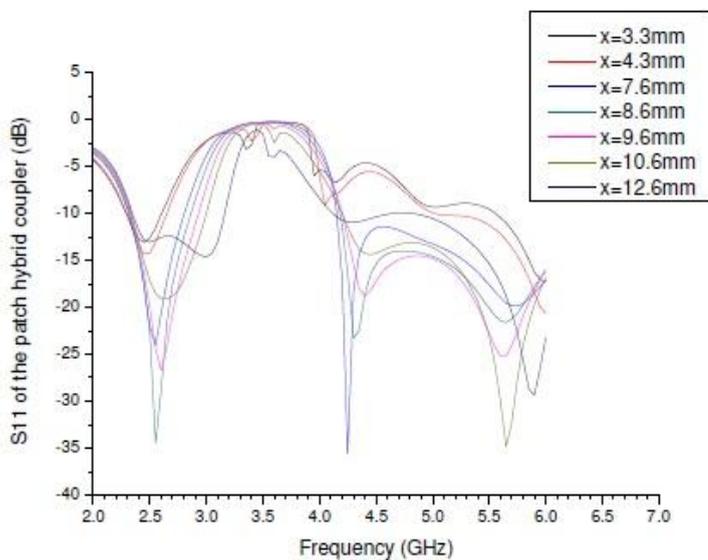
$$\text{Directivity} = \text{Isolation} - \text{Coupling} = -20 \log_{10} \left| \frac{S_{31}}{S_{41}} \right|$$

Indicates ability to separate coupled and isolated signals; calculated from isolation and coupling measurements.

Multiband Rectangular Disc Hybrid coupler



Patch hybrid coupler parameters (S_1 , S_w , T , b , a) are optimized using either segment method or evolutionary algorithm. Adding 4 open-circuit stubs enables dual-band operation, with stub position (x) optimized for best performance.



Layout of the Multiband Disc Hybrid



Conclusion:

Branch line and rectangular disc multiband hybrid couplers covering Wi-Fi bands were designed and fabricated, showing isolation and return loss better than 10 dB with acceptable insertion loss. A Butler matrix using these couplers and Schiffman phase shifters was also developed for multiband antenna systems.