SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

EMBEDDED CLUB

(Academic Year: 2025 to 2026)

Submitted by
Mr.S.John Powl
Assistant Professor
Faculty Coordinator

Preface

The Embedded Club of the Department of Electrical and Electronics Engineering at Sri Manakula Vinayagar Engineering College functions as a vibrant technical forum established to cultivate innovation, design thinking, and application-oriented competence among students. The club provides a structured academic platform where theoretical foundations are strengthened through systematic technical engagement, collaborative learning, and experiential exposure. Guided by faculty coordinators and actively managed by student office bearers, the club promotes an integrated approach to understanding modern electronic systems from a holistic perspective, emphasizing conceptual clarity, logical reasoning, and structured problem-solving methodologies. It regularly organizes technical discussions, knowledge-sharing sessions, design-oriented activities, interactive workshops, simulation-based explorations, and innovation-driven mini projects to enhance practical insight and analytical capability. The club also encourages interdisciplinary collaboration, teamwork, leadership development, and professional ethics, enabling students to adapt to rapidly evolving technological environments. By fostering creativity, critical thinking, and real-time application perspectives, the Embedded Club plays a significant role in equipping students with industry-relevant competencies, strengthening their technical confidence, and preparing them to become future-ready engineers capable of addressing complex engineering challenges with precision, responsibility, and innovation.

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ABOUT THE INSTITUTION

Sri Manakula Vinayaga Educational Trust was founded to provide quality and affordable education to the weaker sections of society. The trust established Sri Manakula Vinayagar Engineering College (SMVEC) in 1999. SMVEC is an autonomous institution affiliated to Pondicherry University. It offers 13 undergraduate, 8 postgraduate and 11 Research programme in engineering. SMVEC has been accredited by NAAC with “A” grade and NBA. The institution is also accredited by TATA consultancy services. The college has a good placement record with students getting job offers from top companies in India and abroad. SMVEC students have won many awards and accolades for their academic achievements.

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society

Mission

M1: Quality Education:

To provide comprehensive academic system that amalgamates the cutting-edge technologies with best practices.

M2: Research and Innovation:

To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship:

To inculcate the employability and entrepreneurial skills through value and skill-based training.

M4: Ethical Values:

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

Department Vision & Mission

Vision

To promote proficiency in the field of Electrical and Electronics Engineering by creating a stimulating environment for research, innovation and entrepreneurship

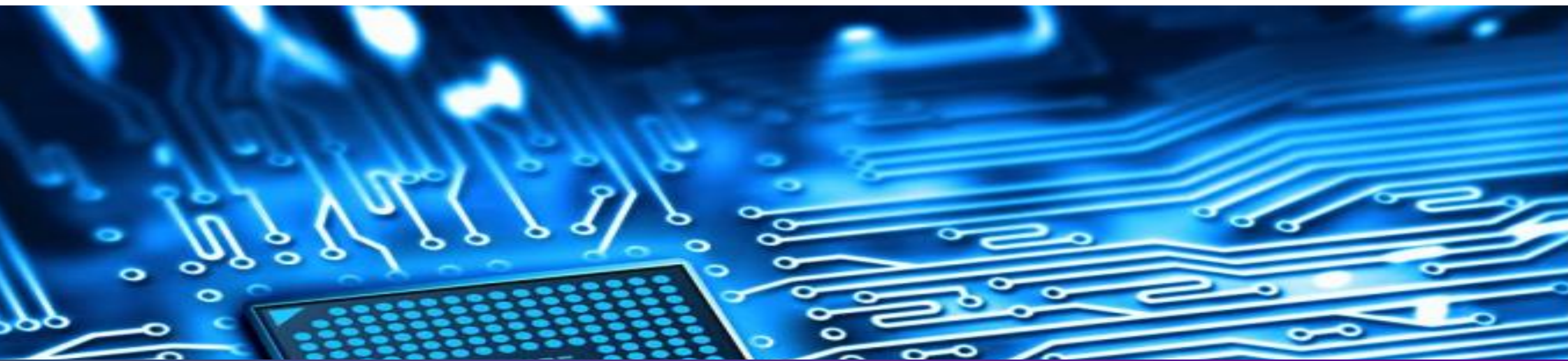
Mission

M1: Quality Education:
To impart high quality technical education with problem solving capabilities by innovative pedagogy in emerging technologies.

M2: Industrial and Societal Needs:
To cater the dynamic needs of the industry and society by strengthening industry-institute interaction.

M3: Research and Innovation:
To nurture the spirit of research attitude by carrying out innovative technologies pragmatically.

M4: Placement and Entrepreneurship:
To inculcate the professionalism in career by advancing synergetic skills to compete in the corporate world.



ABOUT THE EMBEDDED CLUB

Embedded systems are referred to as control systems tailored for specific applications. Embedded systems are used in many different fields such as automotive, robotics, IoT, AI, ML, biomedical equipment, and instrumentation etc. Looking at its diversity of applications and potential for production of highly innovative products, embedded system can be considered as the primary technology of the present and future.

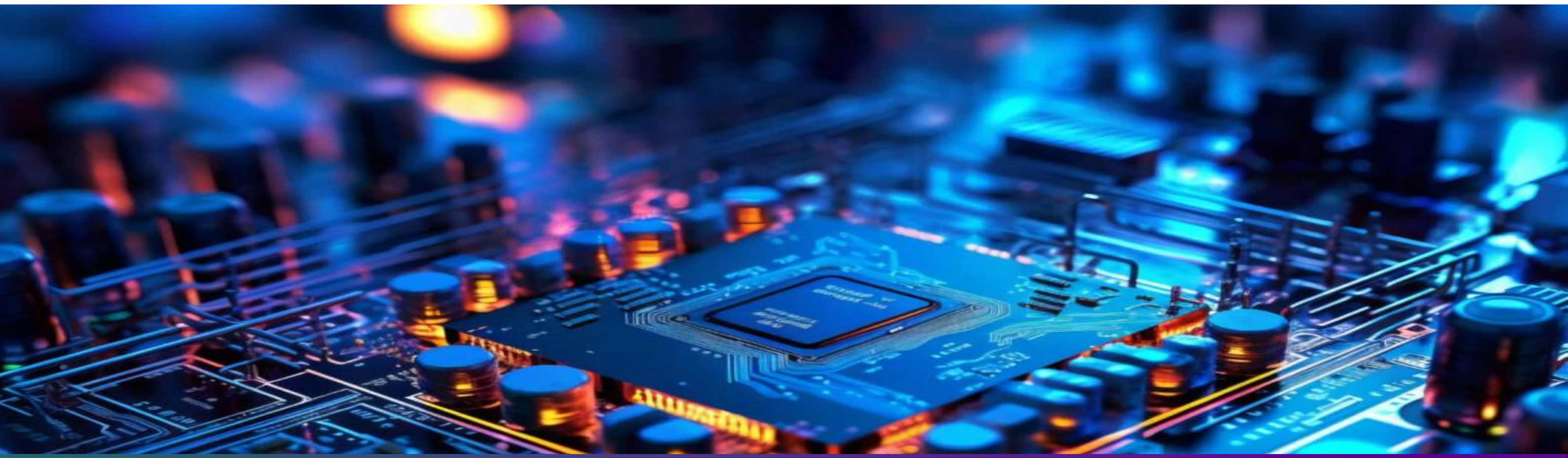
The function of the club is to deal from basics of electronics. This club aims to uncover those key topics that are not part of the curriculum. The club helps the students by integrating their skills in the various fields of engineering and technology to cope up with the highly competitive environment

Objectives of Embedded Club

- To make the students aware of the upcoming embedded system technologies.
- To understand hardware and software design requirements of embedded system.
- To analyze the embedded system specifications and develop software program.
- To create a platform for sharing innovative ideas and to develop mini projects.
- To make students to design real time applications.

Functions

- Organising Lecture session on embedded systems.
- Conducting frequent weekend contest.
- Weekly Hands-on training sessions.
- Designing of interfacing circuits.
- Conducting Hackathon for the benefit of students.



"Where circuits connect and innovation flows."

Office Bearers and portfolios

S.No	Name	Position
1.	Mr.S.John Powl Assistant professor/EEE	Faculty Coordinators
2.	Mr. K.Thangaraj Assistant professor/EEE	
3.	Mr. Devanadhan	President
4.	Mr. Gowtham	Vice president
5.	Mr. Gunanidhi	Secretary
6.	Mr. Manimurugan	Joint Secretary
7.	Mr. Mohamad farook	Executive Member
8.	Mr. Raja Sabari	Technical Member


Mr.S.John Powl
Assistant professor/EEE
Staff Coordinator


Devanadhan
President


Gowtham
Vice president


Gunanidhi
Secretary


ManiMurgan
Joint Secretary


Mohamad Farook
Executive Member

Embedded club – Activity Report-1

Academic Year :	**2025 – 2026**	
Date/Day :	**09.08.2025/Saturday**	**Year/Sem/Sec: II/III/A ,B**
Activity :	**DESIGN OF MOBILE PHONE DETECTOR CIRCUIT**	

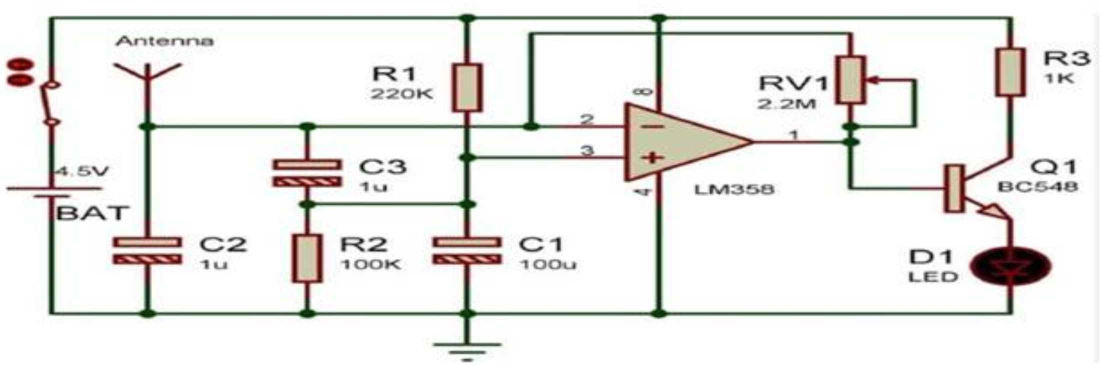
INTRODUCTION

- The mobile phone detector circuit is an electronic device designed to sense the presence of an active mobile phone by detecting the electromagnetic signals emitted during communication or data transmission.
- When a mobile phone is used for making or receiving calls, sending messages, or accessing the internet, it generates radio frequency (RF) signals typically in the range of 0.9 GHz to 3 GHz. The detector circuit captures these signals and indicates the phone's activity through visual or audible alerts.
- The circuit is compact, low-cost, and highly sensitive, making it useful in places where mobile phone usage is restricted, such as examination halls, conference rooms, and military areas.
- The design demonstrates the practical application of RF detection techniques using basic electronic components such as capacitors, transistors, and inductors to convert invisible electromagnetic signals into detectable outputs.

APPLICATIONS:

1. **Examination Halls –** Prevents unfair practices by detecting phone activity.
2. **Confidential Meetings –** Protects sensitive discussions from eavesdropping.
3. **Libraries & Auditoriums –** Maintains silence by warning about active mobile phones.
4. **Secure/Restricted Zones –** Enhances security by identifying unauthorized phone usage.
5. **Hospitals –** Ensures mobile phones don't interfere with sensitive equipment.

CIRCUIT DIAGRAM OF MOBILE PHONE DETECTOR:



WORKING OF MOBILE PHONE DETECTOR:

The detector circuit works by using an antenna to pick up electromagnetic signals generated whenever a mobile phone is active nearby. The input signal is filtered and amplified through a combination of passive capacitors (C1, C2, C3) and an operational amplifier (LM358). The amplified signal is then passed through a variable resistor (RV1) that adjusts the sensitivity as required by the application. The resulting output is fed to the base of a transistor (Q1 BC548), which drives an LED (D1) as a visual indicator. When a transmission is detected within the proximity (typically up to 1–2 meters), the LED glows, alerting the presence of a transmitting mobile phone. Power is supplied by a small 4.5V battery, making the system portable and easy to deploy.

DESIGN CALCULATION:

1. Op-Amp Gain Calculation

The voltage gain (A_v) of the amplifier section (using LM358) is primarily set by the ratio of the feedback resistor RV1 (2.2MΩ max) to the input resistor R2 (100kΩ):

$$\boldsymbol{A_v = 1 + (R_V1/R_2)}$$

$$\boldsymbol{If RV1 is at max, A_v = 1 + \frac{2.2M\Omega}{100k\Omega} = 23}$$

2. Signal Coupling and Filtering

Capacitors C2 (1 µF) and C3 (1 µF) filter unwanted DC offsets and pass only the high-frequency mobile signals (around 900 MHz–1.8 GHz, heavily attenuated to ~kHz for circuit processing).

3. Transistor Switch

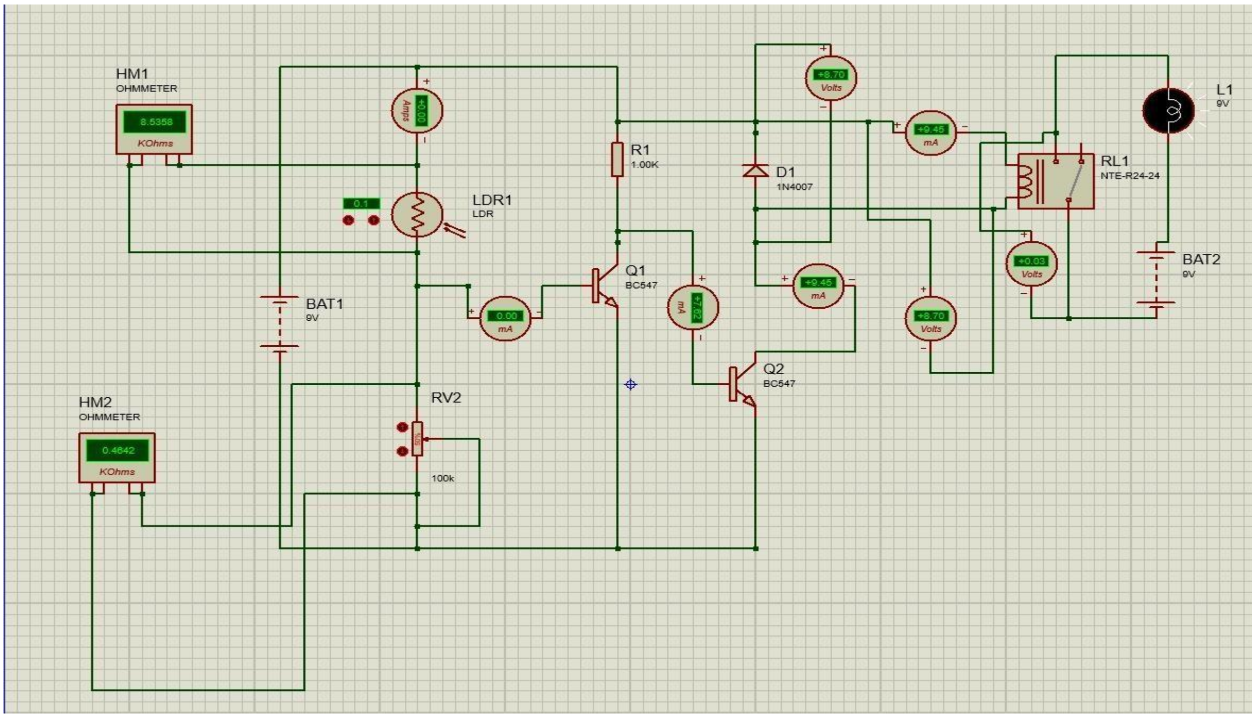
The output current to activate the LED depends on the transistor's gain and the series resistor R3 (1kΩ). For a forward LED voltage of 2V and a supply of 4.5V, current per:

$$I_{LED} = \frac{V_{BAT} - V_{LED}}{R3} = \frac{4.5V - 2V}{1000\Omega} = 2.5\ mA$$

COMPONENTS REQUIRED FOR CIRCUIT:

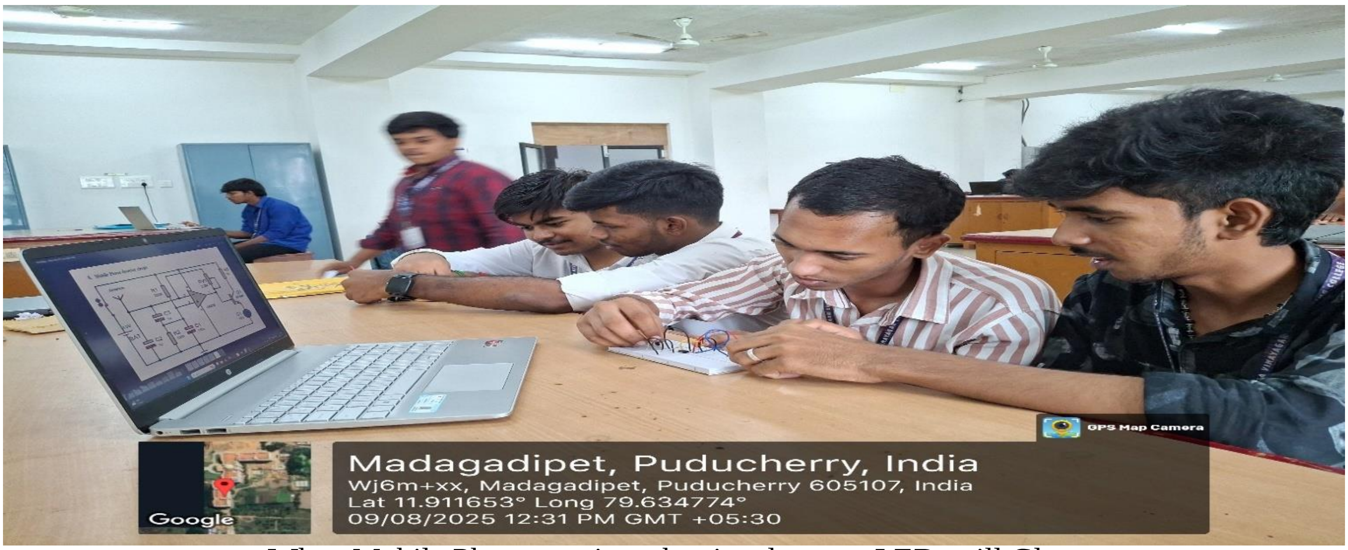
S.No	Components	Specifications	Quantity
1	Antenna	RF Wire	1
2	Resistor	220kΩ, 100kΩ, 1kΩ	1 each
3	Potentiometer	2.2MΩ	1
4	Capacitor	1µF (2), 100µF (1)	3
5	Op-amp	LM358	1
6	Transistor	BC548	1
7	LED	Standard	1
8	Battery	4.5V	1
9	Wires	—	As needed

SIMULATION DIAGRAM OF MOBILE PHONE DETECTOR:

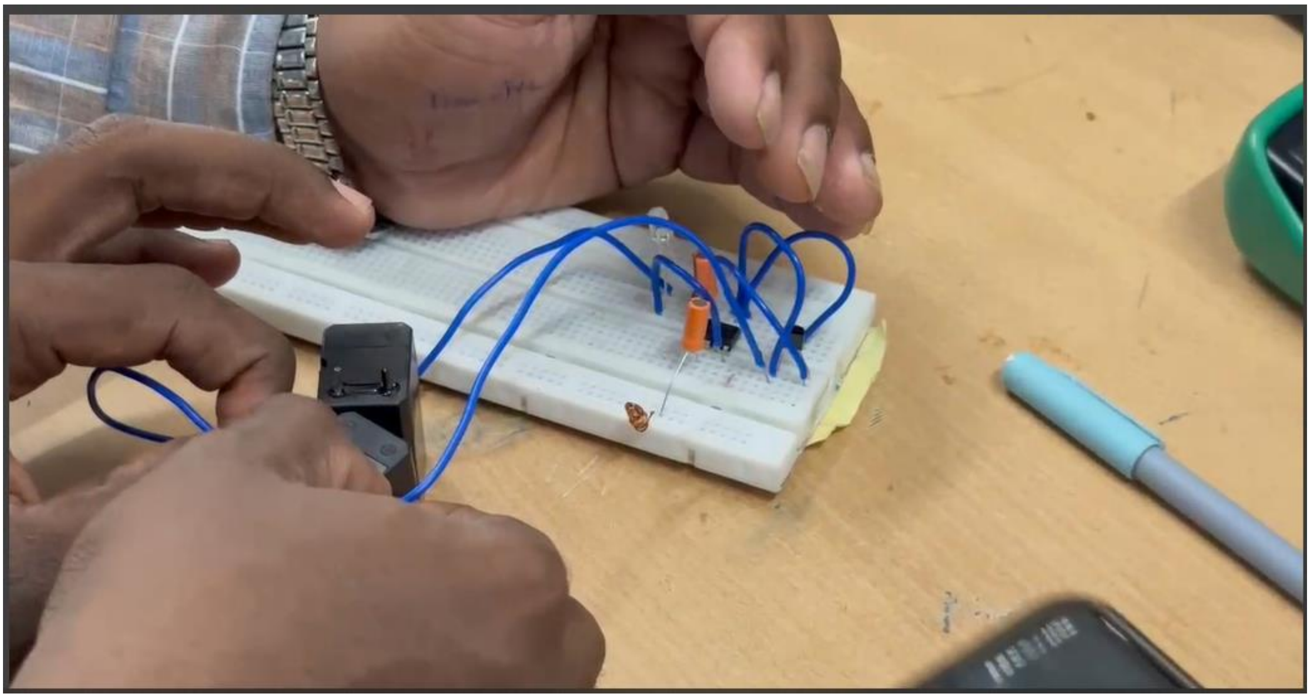


OUTPUT:

PARAMETERS	THEORETICAL VALUE	SIMULATION VALUE	PRACTICAL VALUE
Supply Voltage	4.5 V	4.48 V	4.5 V
Standby Current	2 mA	2.1 mA	2.2 mA
LED Current on Detect	2.5 mA	2.3 mA	2.6 mA
Detection Range	1.5 m	1.3 m	1.5 m
Sensitivity (RV1 Max)	High	High	High



When Mobile Phone receives the signal output LED will Glow



When the Mobile Phone not receives the signal output LED will not Glow

Embedded club – Activity Report-2

Academic Year	2025 – 2026	
Date / Day	27.12.2025 / Saturday	**Year/Sem/Sec:** III/VI/B
Topic	Embedded System Development and Sensor Interfacing Using STM32	
Content	**Demonstration and Installation** • STM32CubeMX • STM32CubeIDE • STM32 Motor Control Software Development Kit (MCSDK)	

Introduction

Embedded systems are vital in modern electronics, powering applications from robotics to IoT. STM32 microcontrollers, like the STM32F411CEU6, are popular for their performance, low power use, and peripheral support.

Tools such as STM32CubeMX, STM32CubeIDE, and the STM32 Motor Control Software Development Kit (MCSDK) simplify development. STM32CubeMX allows easy peripheral configuration and code generation, while STM32CubeIDE provides integrated coding, compiling, and debugging. MCSDK offers ready-to-use libraries for motor control projects.

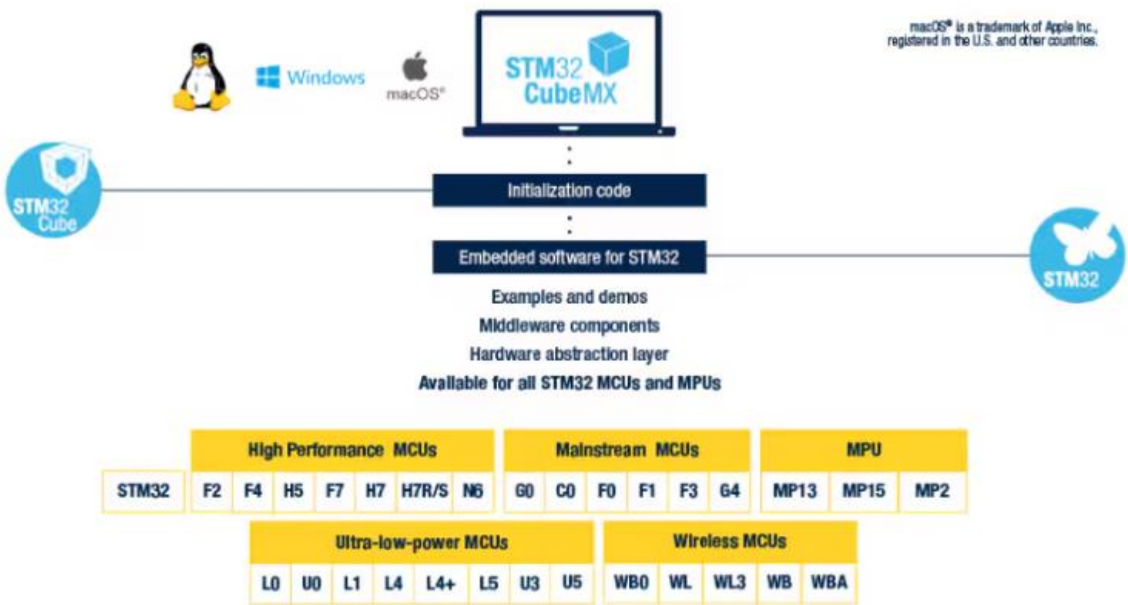
Together, these tools enable efficient design, rapid prototyping, and error reduction. This work demonstrates installation, setup, and application of these tools for sensor interfacing and variable power supply monitoring projects.

Objective

- To expertise the features and functionalities of STM32CubeMX, STM32CubeIDE, and the STM32 Motor Control Software Development Kit (MCSDK).
- To establish the installation and setup process of STM32CubeMX and STM32CubeIDE on a development system.
- To explore peripheral configuration and automatic code generation using STM32CubeMX.
- To familiarize with the workflow for embedded system development using STM32 microcontrollers.

Software Used

- STM32CubeMX
- STM32CubeIDE
- STM32 Motor Control Software Development Kit (MCSDK)



STM 32 Implementation

Methodology: Installation of STM32 Development Tools

Step 1: Prepare the System

- Ensure the PC meets the minimum requirements: Windows 10/11, macOS, or Linux, with at least 4 GB RAM and 10 GB free disk space.
- Stable internet connection for downloading installation files.

Step 2: Download STM32CubeMX

- Visit the official STMicroelectronics website: https://www.st.com
- Navigate to STM32CubeMX in the “Tools & Software” section.
- Download the installer suitable for your operating system.

Step 3: Install STM32CubeMX

- Run the downloaded installer.
- Follow the on-screen instructions: accept the license agreement, choose the installation path, and complete the installation.
- Launch STM32CubeMX to verify successful installation.

Step 4: Download STM32CubeIDE

- Go to the STMicroelectronics website and navigate to STM32CubeIDE.
- Download the latest version compatible with your OS.

Step 5: Install STM32CubeIDE

- Run the installer and follow the instructions.
- Choose default installation options unless a custom path is required.
- Launch STM32CubeIDE to check proper setup.

Step 6: Install STM32 Motor Control Software Development Kit (MCSDK)

- Open STM32CubeIDE.

- Navigate to Help → Manage Embedded Software Packages → Install or Update MCSDK.
  - Select the STM32 family (e.g., STM32F4 series) and download the MCSDK package.
  - Verify installation by checking example projects provided in the MCSDK.

Step 7: Verify Installation

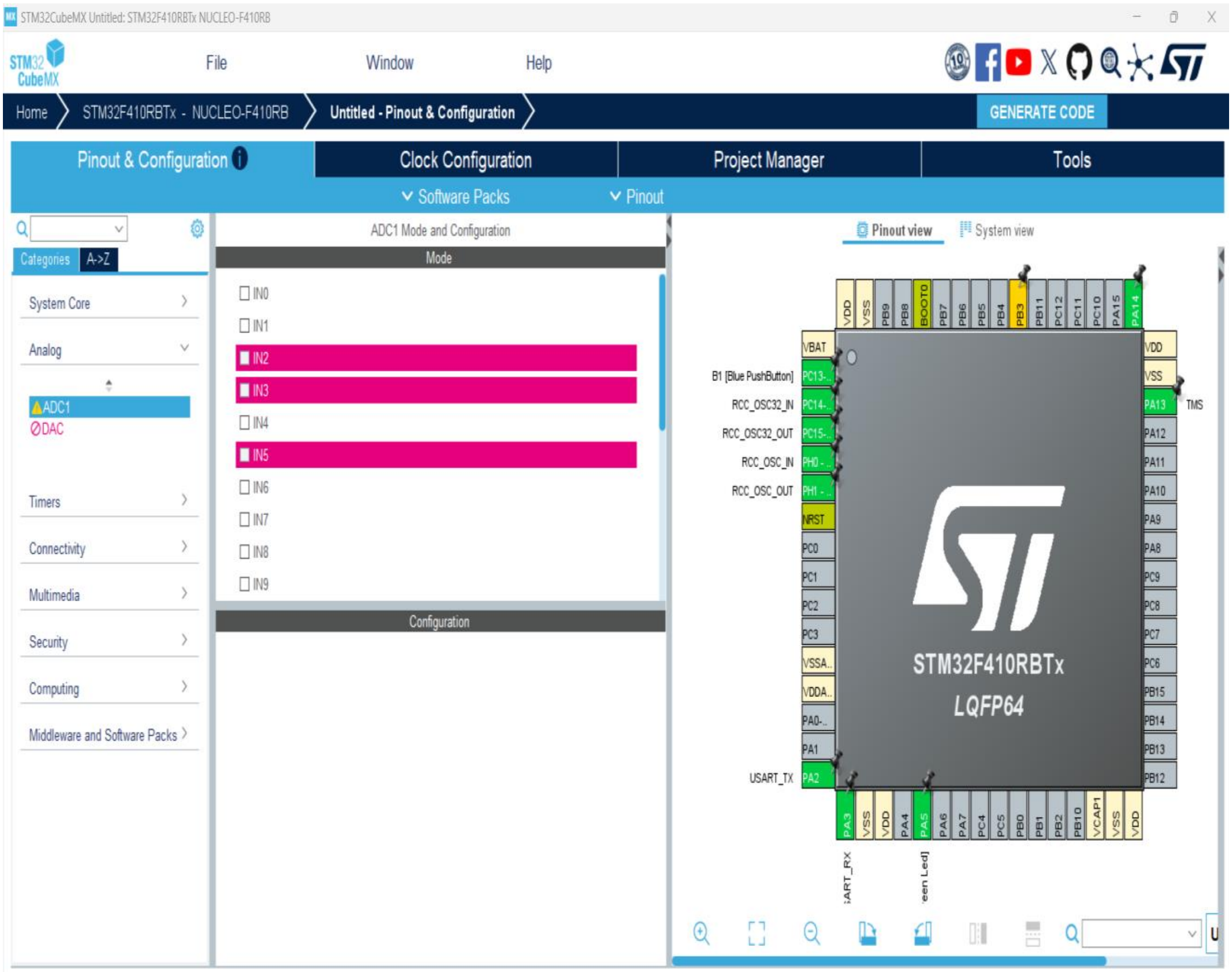
- Open a sample project from MCSDK (e.g., motor control demo).
- Compile and build the project to ensure the IDE, CubeMX, and MCSDK are working correctly.

Outcomes

The successful installation and demonstration of STM32CubeMX, STM32CubeIDE, and the STM32 Motor Control Software Development Kit (MCSDK) provide a complete and efficient development environment for STM32 microcontrollers.

Through this process, users gain practical knowledge of configuring microcontroller peripherals, generating initialization code, and developing embedded applications within an integrated platform. The MCSDK enables quick development and testing of motor control applications using preconfigured libraries and examples.

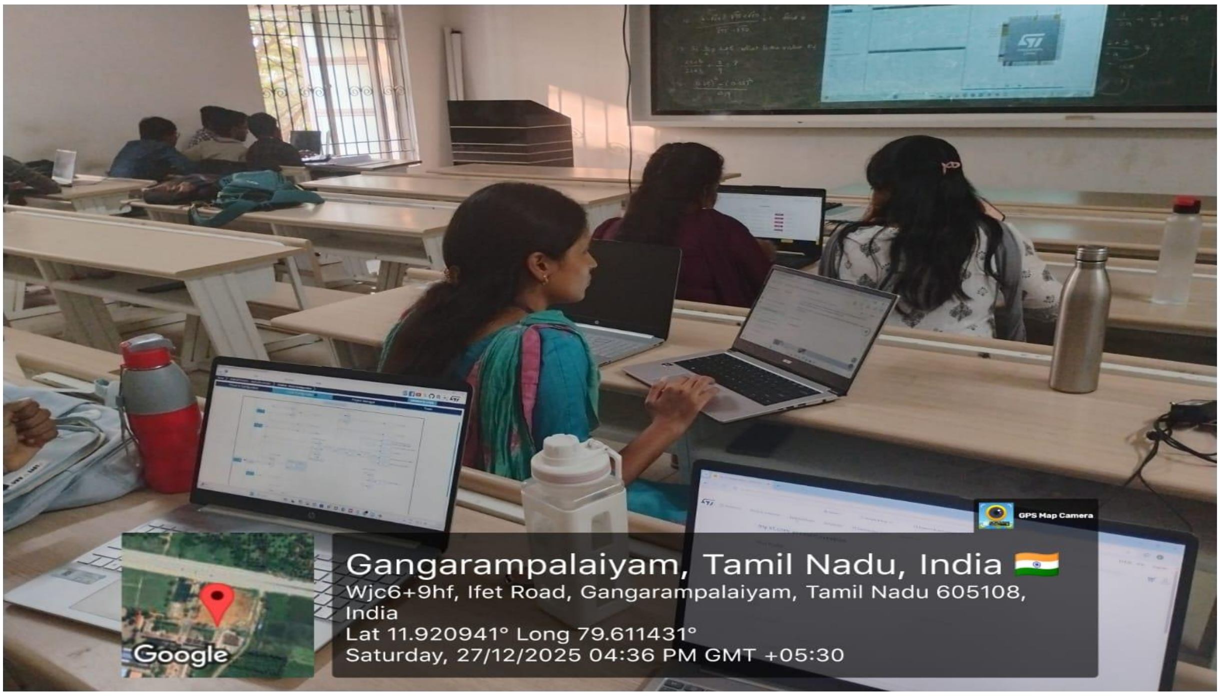
Overall, this setup improves development efficiency, reduces configuration errors, and enhances understanding of STM32-based embedded system design, making it suitable for academic learning, prototyping, and real-time application development.



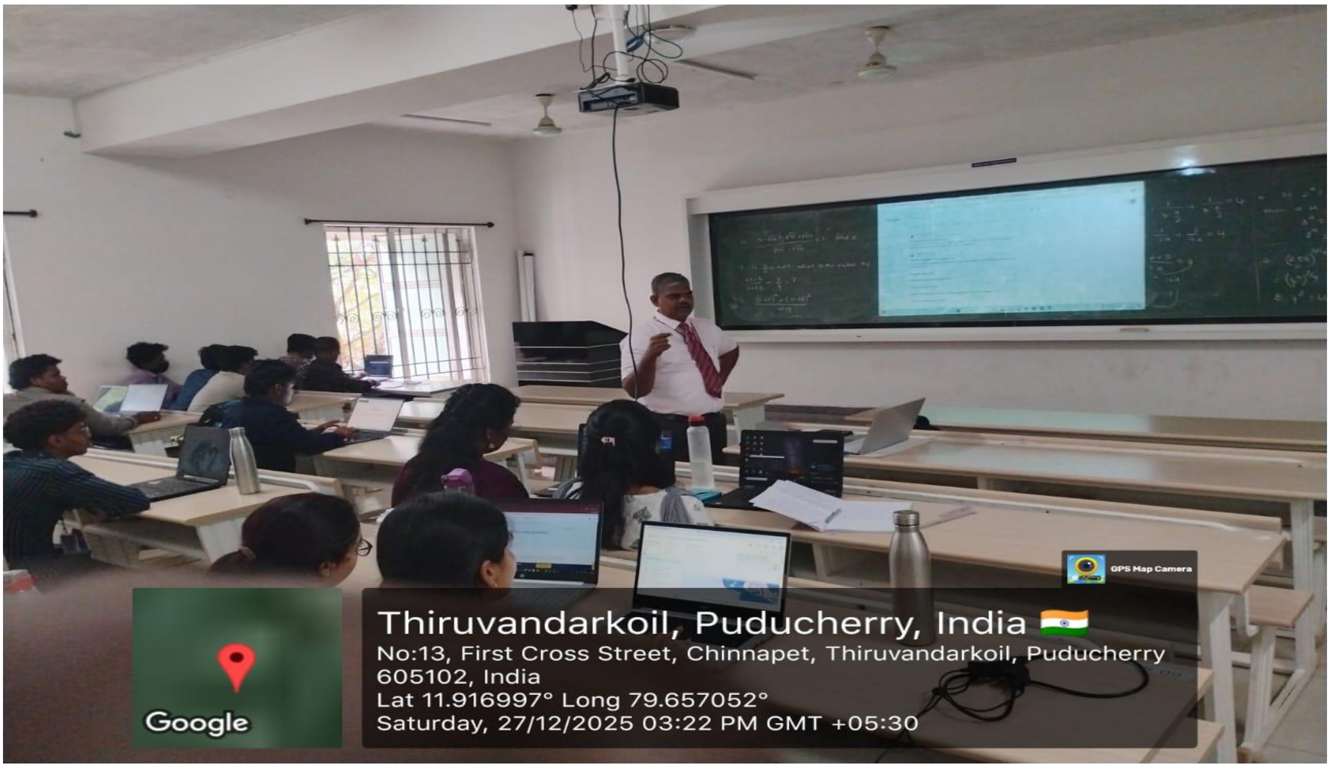
Pinout and Configuration of STM32F410RBTx

Practicing STM32CubeMX Software Development Tools - Students of the third Year A Section

Students of the third Year A Section – Exercising STM32CubeIDE Software Development Tools



Execution of STM32 Motor Control Software Development Kit (MCSDK) - Students of the third Year A Section



Demonstration of STM32 Software Development Tools to the Students of third Year A Section

Embedded club – Activity Report-3

Academic Year	2025 – 2026	
Date / Day	24.01.2026 / Saturday	**Year/Sem/Sec:** III/VI/B
Topic	Embedded System Development and Sensor Interfacing Using STM32	
Content	Interfacing STM32F411CEU6 ADC with UART for Real-Time Data Visualization using Python and Matplotlib	

Introduction

Real-time data acquisition and visualization are essential in embedded system development and testing. This exercise focuses on interfacing the ADC of the STM32F411CEU6 microcontroller with UART communication to stream analog sensor data to a host computer.

The STM32's high-resolution ADC captures real-world signals, while UART provides a simple and reliable serial interface for data transfer. On the host side, Python is used to receive, process, and plot the incoming data using Matplotlib.

This setup enables live monitoring, analysis, and debugging of analog signals, offering a practical foundation for signal processing, control systems, and IoT applications in educational and industrial environments.

Objective

- To configure and utilize the ADC of the STM32F411CEU6 microcontroller for accurate acquisition of analog signals and transmit the digitized data through UART communication in real time.

- To develop a Python-based data visualization system using Matplotlib that receives UART data and displays live graphical plots for effective monitoring and analysis of ADC signals.

Software Used

- Notepad++
- ARM GCC Compiler
- Visual Studio Code (VS Code)
- STM32CubeMX with F controller series patch support
- Tera Term 5
- Python with Matplotlib

Hardware used

Diode	1N4007	- 4 Nos
Resistor	1 kΩ	- 1 Nos
Resistor	3.3 kΩ	- 1 Nos
Transformer	0 -12V	- 1 Nos
STM32		- 1 Nos
Type A to Type C Cable		- Required
STLingV2 debugger Connecting wires		- Required

- Bread board - 1 Nos
- Laptop - 1 Nos

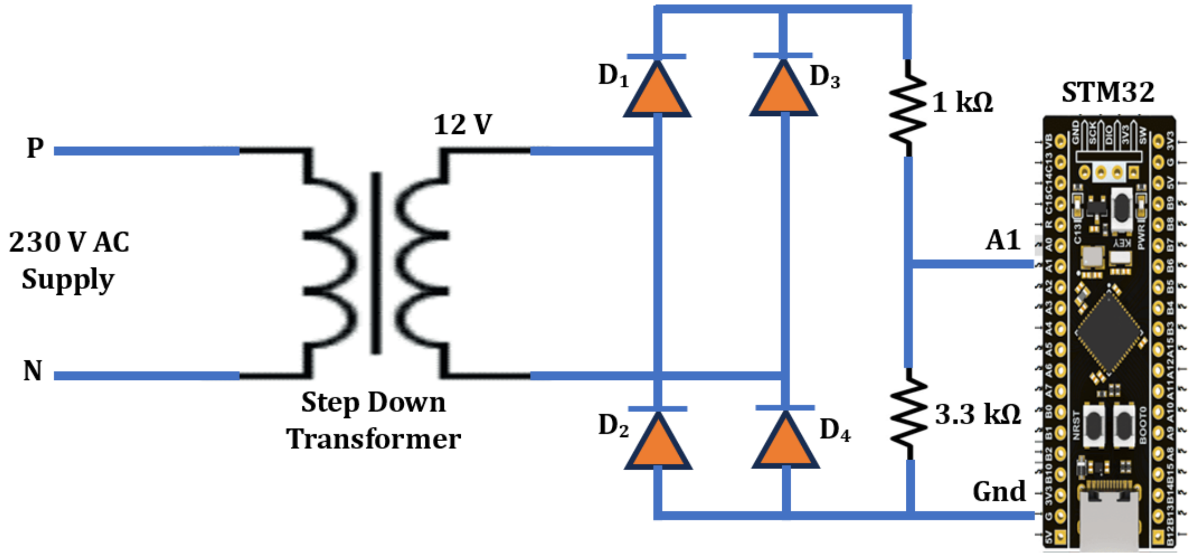


Fig.1 AC mains voltage sensing circuit using transformer, bridge rectifier, and STM32 ADC interface.

The Fig.1 shows a mains voltage sensing circuit interfaced with an STM32 microcontroller. A 230 V AC supply (Phase P and Neutral N) is connected to a step-down transformer, which reduces the voltage to 12 V AC and provides electrical isolation. The transformer output is fed to a full-wave bridge rectifier consisting of four diodes (D1, D2, D3, and D4), which converts the AC voltage into pulsating DC. The rectified output is then applied to a voltage divider network made up of 1 kΩ and 3.3 kΩ resistors to scale the voltage to a safe level. The reduced voltage is connected to the A1 analog input pin of the STM32 microcontroller, with the common ground connected to the STM32 GND. This arrangement enables the microcontroller to measure and monitor the AC mains voltage safely using matplotlib.

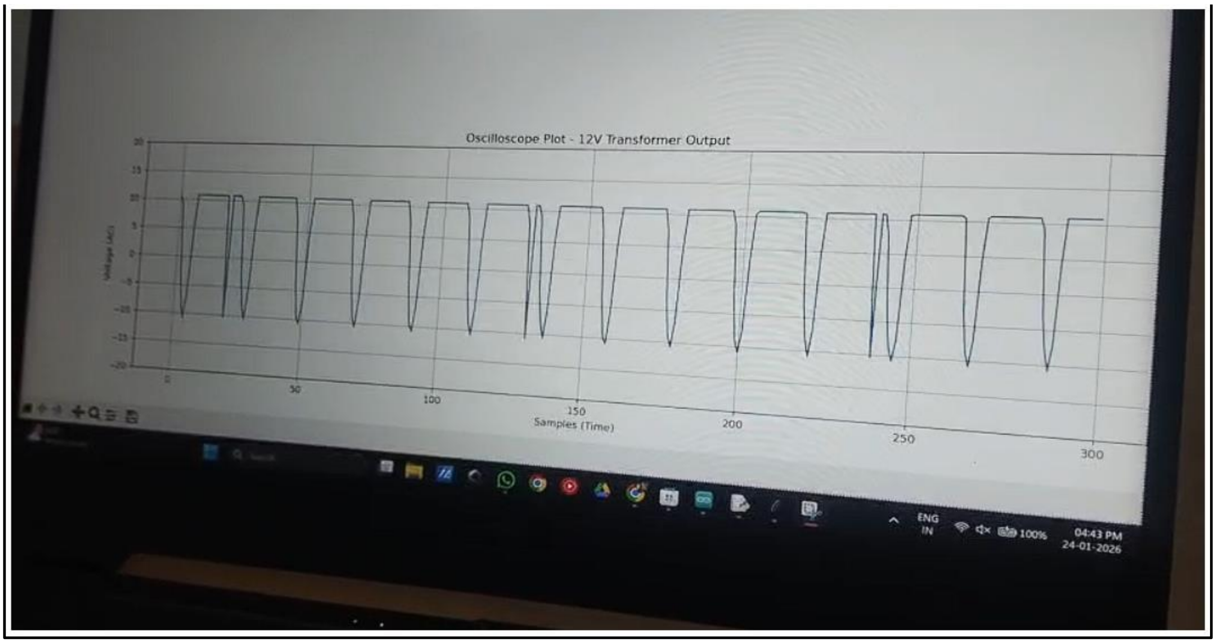
Methodology: Interfacing of STM32F411CEU6 in VS Code

Step 1: Install the software Visual Studio Code
Step 2: Create a new file
Step 3: Go to the terminal command prompt
Step 4: Open the path of "D:\STM32_Black_Pill\STM32F411\ADC_Data_Logger\Rectifier_Sampling\get_pip.py"
Step 5: Check for pip install matplotlib or install
Step 6: Check for pip install pyserial
Step 7: Now open the Python script ("D:\STM32_Black_Pill\STM32F411\ADC_Data_Logger\Rectifier_Sampling\Python_script.py")
Step 8: Check for the COM port in Device Manager
Step 9: Give the same in Python_script.py
Step 10: Now save and run, then can see the matplotlib on screen

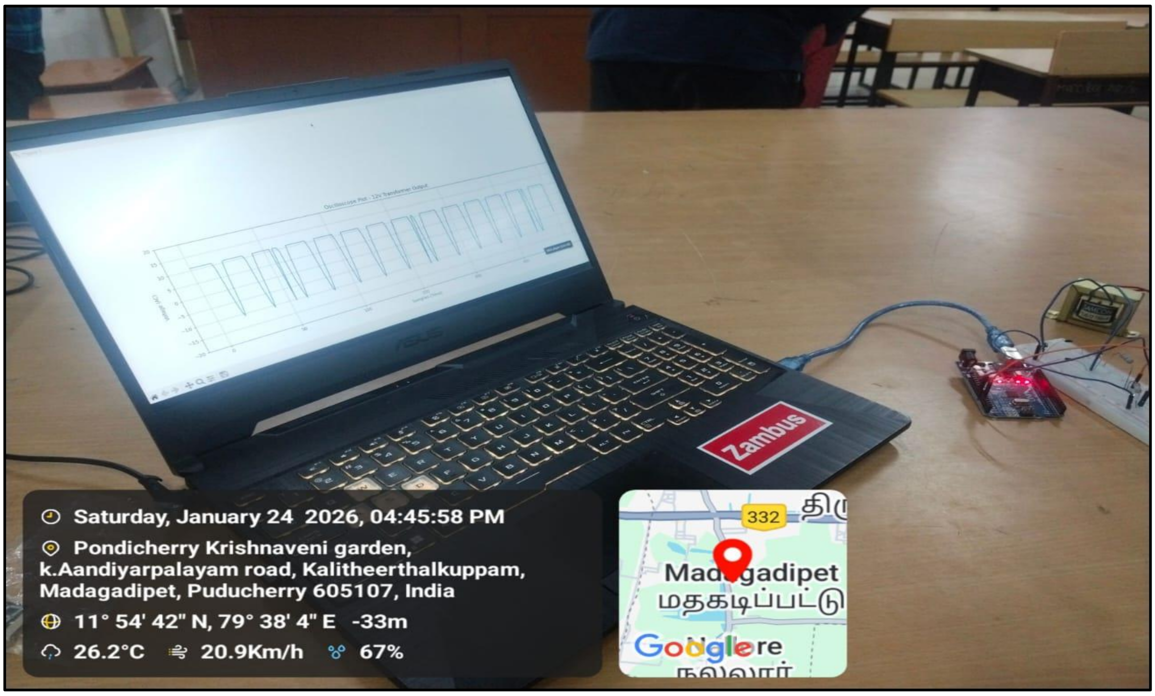
Outcomes

The successful implementation of this exercise results in a reliable real-time data acquisition and visualization system using the STM32F411CEU6 microcontroller. Analog signals are accurately captured through the ADC and transmitted via UART to a host computer without significant delay.

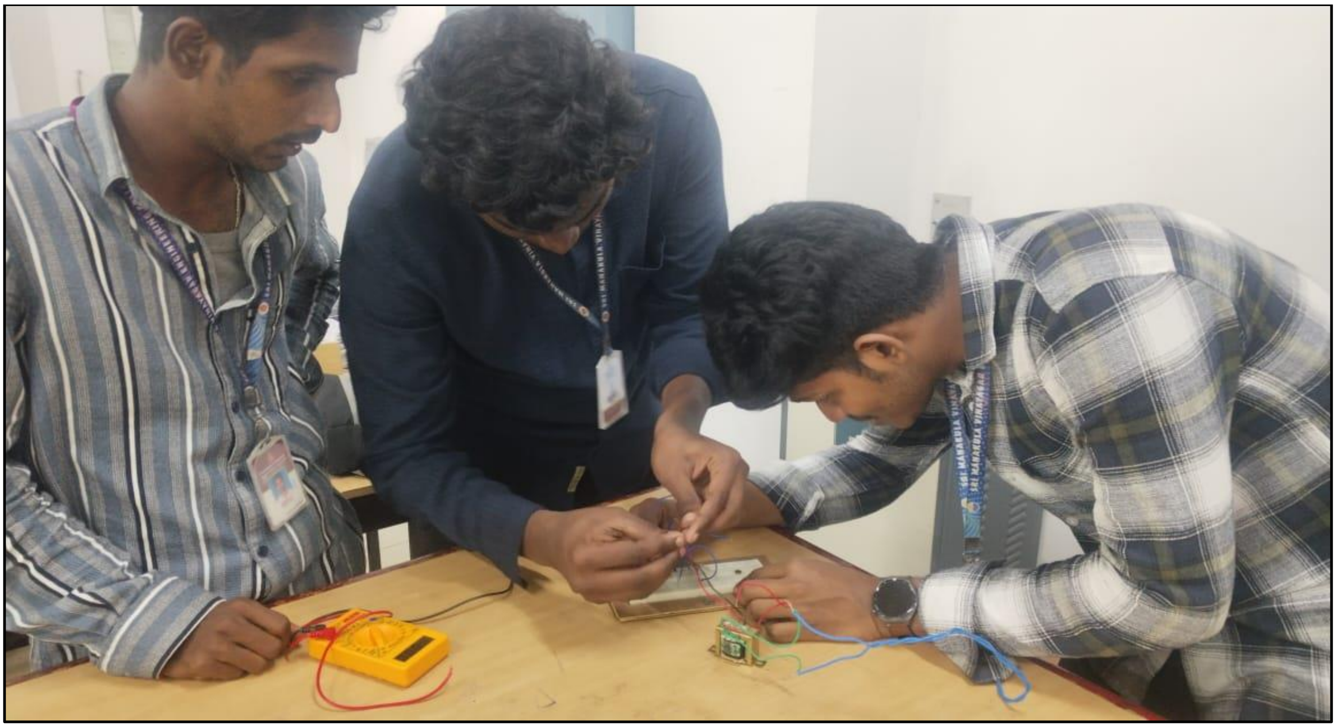
The Python application efficiently receives and processes the serial data, displaying live plots using Matplotlib. This outcome demonstrates effective hardware–software integration, enhances understanding of embedded communication protocols, and provides a scalable framework for real-time signal monitoring and analysis in embedded and IoT applications.



Matplotlib view of AC mains sensing circuit interfaced with STM32 Microcontroller



AC mains sensing circuit interfaced with STM32 Microcontroller - Students of the third Year B Section



Hardware of AC mains sensing circuit interfaced with STM32 Microcontroller - Students of the third Year B Section

Execution of hardware interfacing with STM32 Microcontroller - Students of the third Year B Section

Embedded club – Activity Report-4

Academic Year	2025 – 2026	
Date / Day	31.01.2026 / Saturday	**Year/Sem/Sec:** III/VI/A&B
Topic	Embedded System Development and Sensor Interfacing Using STM32	
Content	Interfacing STM32F411CEU6 ADC with UART for Real-Time Data Visualization using Python and Matplotlib	

Introduction

Interfacing microcontrollers with external systems for real-time data monitoring is a fundamental requirement in modern embedded applications. This project focuses on interfacing the Analog-to-Digital Converter (ADC) of the STM32F411CEU6 microcontroller with UART communication to enable real-time data visualization on a host computer.

The STM32F411CEU6's high-resolution ADC converts analog sensor signals into digital data, which is transmitted via UART to a PC. On the host side, Python is used to receive, process, and visualize the data using Matplotlib. This approach provides an effective platform for real-time signal analysis, system debugging, and validation in embedded, control, and IoT-based applications.

Objective

- To configure and interface the ADC of the STM32F411CEU6 microcontroller with UART communication for acquiring and transmitting real-time analog sensor data.

- To develop a Python-based application using Matplotlib for receiving, processing, and visualizing the transmitted data, enabling real-time monitoring and analysis of analog signals.

Software Used

- Notepad++
- ARM GCC Compiler
- Visual Studio Code (VS Code)
- STM32CubeMX with F controller series patch support
- Tera Term 5
- Python with Matplotlib

Hardware used

Diode	1N4007	- 4 Nos
Resistor	1 kΩ	- 1 Nos
Resistor	3.3 kΩ	- 1 Nos
Transformer	0 -12V	- 1 Nos
STM32		- 1 Nos
Type A to Type C Cable		- Required
STLingV2 debugger Connecting wires		- Required
Bread board		- 1 Nos
Laptop		- 1 Nos

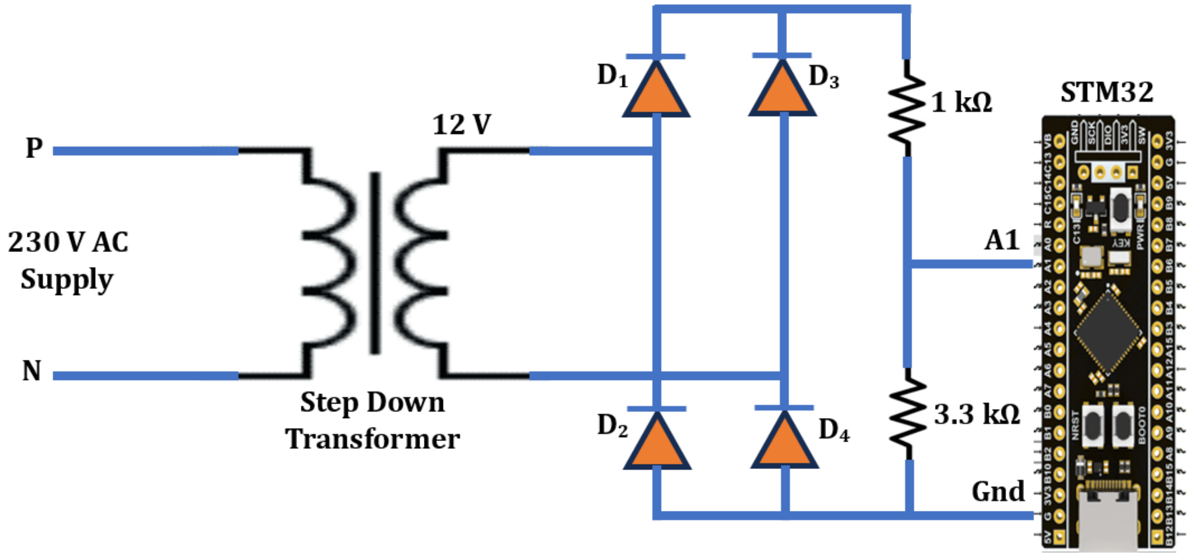


Fig. 1. Schematic diagram of an isolated AC mains voltage sensing circuit with a step-down transformer, full-wave bridge rectifier, and resistive voltage divider for STM32 ADC interfacing.

Fig.1 illustrates an AC mains voltage sensing circuit interfaced with an STM32 microcontroller. The 230 V AC supply (Phase P and Neutral N) is first stepped down to 12 V AC through a transformer that also provides galvanic isolation for safety. The reduced AC voltage is then converted into pulsating DC using a full-wave bridge rectifier composed of diodes D1–D4. The rectified output is further attenuated through a resistive voltage divider network (1 kΩ and 3.3 kΩ) to obtain a safe and measurable voltage level. This scaled voltage is applied to the A1 analog input pin of the STM32, with a common ground reference connected to the STM32 GND. This configuration allows the microcontroller to safely measure and monitor the mains voltage.

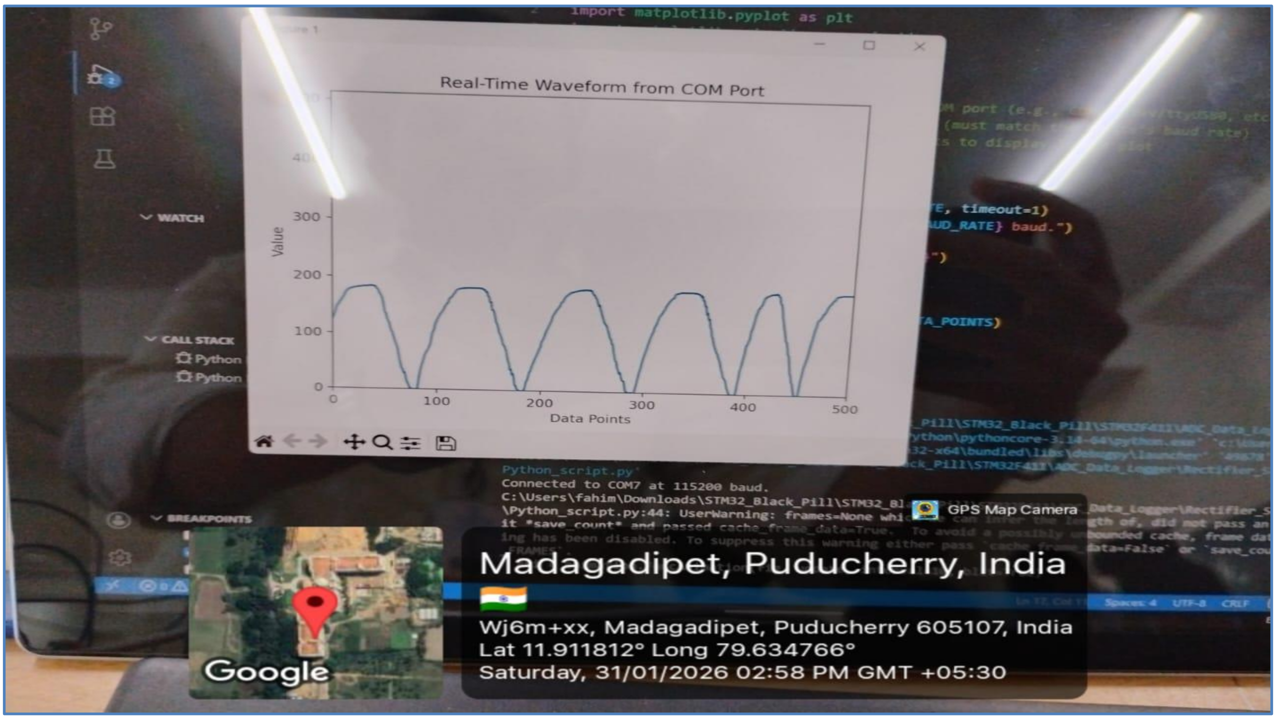
Methodology: Interfacing of STM32F411CEU6 in VS Code

Step 1: Install the software Visual Studio Code
Step 2: Create a new file
Step 3: Go to the terminal command prompt
Step 4: Open the path of
"D:\STM32_Black_Pill\STM32F411\ADC_Data_Logger\Rectifier_Sampling\get_pip.py"
Step 5: Check for pip install matplotlib or install
Step 6: Check for pip install pyserial
Step 7: Now open the Python script
("D:\STM32_Black_Pill\STM32F411\ADC_Data_Logger\Rectifier_Sampling\Python_script.py")
Step 8: Check for the COM port in Device Manager
Step 9: Give the same in Python_script.py
Step 10: Now save and run, then can see the matplotlib on screen

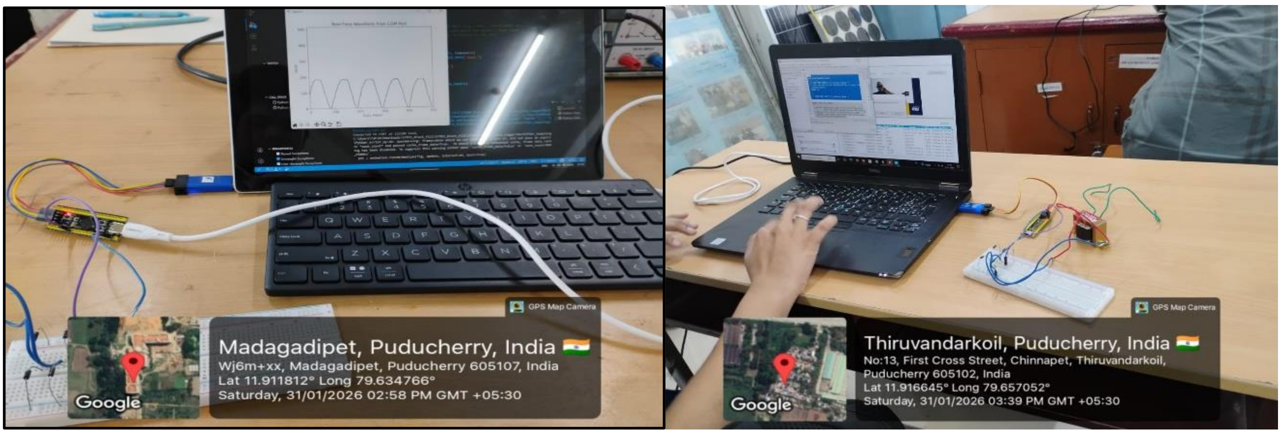
Outcomes

The successful implementation will be able to configure and utilize the ADC of the STM32F411CEU6 microcontroller to accurately acquire real-time analog signals. The learner will also gain hands-on experience in implementing UART communication for reliable data transmission between an embedded system and a host computer.

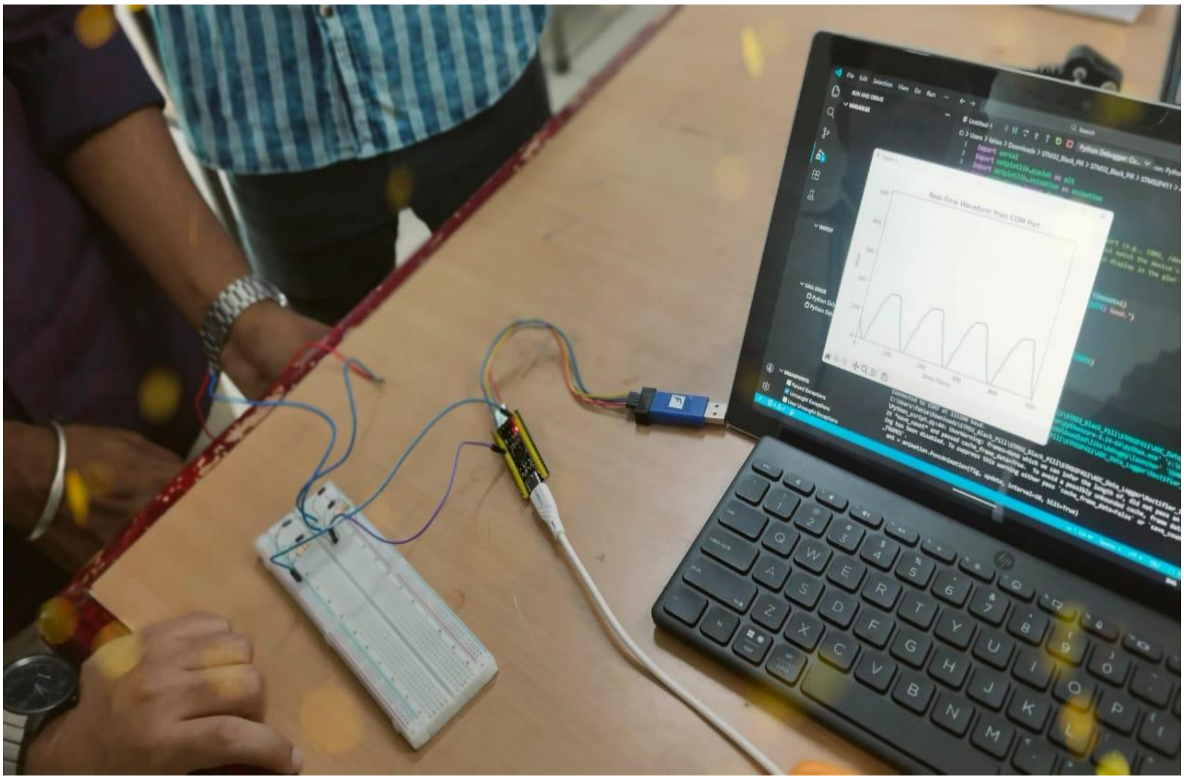
Additionally, the learner will be able to develop a Python-based application to receive, process, and visualize real-time data using Matplotlib. These outcomes enhance understanding of embedded data acquisition, serial communication, and real-time visualization, providing practical skills applicable to signal processing, system debugging, control systems, and IoT-based embedded applications.



Matplotlib visualization of an AC mains voltage sensing circuit interfaced with an STM32 microcontroller



Hardware connection of AC mains voltage sensing circuit interfaced with an STM32 microcontroller - Students of the third Year A & B Section



Implementation of hardware interfacing with STM32 microcontroller - Students of the third Year A & B Section