

Medi-Track System

Prathamesh Mulukh¹, Sanchita Sable², Om Nikam³, Aditya Mali⁴, Dr. Yugendra D Chincholkar⁵, Namita Shinde⁶, Dr. Sachin Takale⁷

^{1,2,3,4} Student, Department of Electronics and Communication Engineering School of Engineering and Sciences, Mit Adt University Rajbaug, Loni Kalbhor, Pune – 412201

⁵Guide, Professor, Mit Adt University

⁶Professor, Project Co-ordinator, Mit Adt University

⁷Professor, Program Head, ECO Mit Adt University

Abstract—In recent years, rapid advancements in technology have transformed the healthcare sector, leading to the development of smart patient monitoring solutions. These systems are designed to continuously observe vital health parameters and provide real-time information to caregivers and medical professionals. Conventional monitoring methods depend on periodic manual checks, which may delay response during emergency situations. In contrast, a smart monitoring system automates this process, enabling early detection of abnormalities and improving overall patient safety and response time. The Medi Track System integrates multiple biomedical sensors to measure key parameters such as heart rate, body temperature, blood oxygen saturation (SpO₂), and ECG signals. These sensors are interfaced with the Raspberry Pi 3 Model B+, which processes the collected data and manages system operations. The processed information is displayed on a 3.5-inch screen for real-time monitoring. Wireless communication using built-in Wi-Fi allows the data to be transmitted for remote access, making it possible to monitor patients from different locations. This system can be effectively used in hospitals, clinics, and home environments for continuous health observation without the need for constant physical supervision.

An important feature of the system is its alert mechanism, which activates when any measured parameter exceeds the normal range. In such cases, a buzzer provides immediate audio notification to alert nearby caregivers. Additionally, the system can store data for future analysis, helping doctors understand patient health trends and make better clinical decisions. Overall, the proposed system enhances the efficiency of patient monitoring while reducing the workload on healthcare staff.

- The system enables continuous real-time monitoring of patient health parameters for improved medical observation.

- Wireless connectivity allows remote access to patient data from different locations using internet-based communication.
- The buzzer alert mechanism helps caregivers respond quickly when abnormal health conditions are detected.

Photograph Of the Medi-Track System

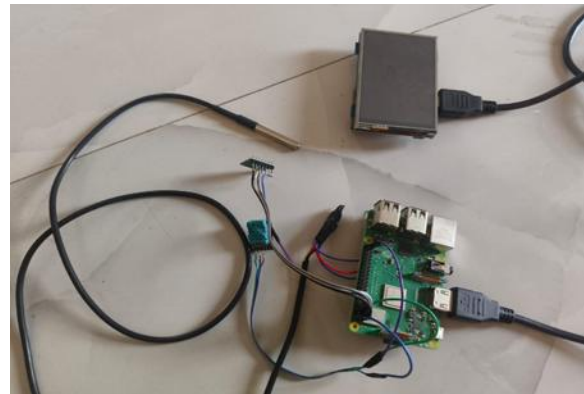


Fig 1.0: Actual photography of project hardware

I. INTRODUCTION

The healthcare sector is rapidly advancing with the adoption of modern technologies aimed at improving patient care and medical services. One of the key limitations of traditional healthcare systems is the reliance on manual monitoring, which may result in delayed response during emergency conditions. With the increasing number of patients and rise in chronic diseases, healthcare facilities are under pressure to deliver faster and more efficient services. This has created a need for intelligent and automated systems

that can assist medical professionals in continuous patient monitoring.

Monitoring vital signs on a continuous basis is essential, especially for patients with long-term illnesses, elderly individuals, or those recovering from surgeries. Detecting abnormal conditions at an early stage can help prevent serious complications and improve survival rates. However, constant human supervision is not always practical, particularly in busy hospitals or remote locations. Therefore, there is a strong requirement for systems that can provide accurate, real-time monitoring without depending entirely on manual efforts.

Advancements in the Internet of Things (IoT), embedded systems, and wireless communication have made it possible to develop smart health monitoring solutions. These systems use sensors to measure important parameters such as heart rate, body temperature, oxygen saturation, and ECG signals. The collected data is processed and transmitted for further analysis, enabling quick decision-making and reducing the chances of human error while improving reliability.

This project, named Medi Track System, focuses on the design and implementation of a smart patient monitoring solution using the Raspberry Pi 3 Model B+. The system integrates multiple sensors to collect patient data, which is displayed in real time on a 3.5-inch screen and can also be accessed remotely through internet connectivity. An alert mechanism is included to notify caregivers in case of abnormal readings. By automating the monitoring process, the system aims to improve patient safety, reduce response time, and support effective remote healthcare services.

The implementation of the Medi Track System provides several benefits, including real-time access to patient data, reduced workload for healthcare professionals, and improved overall patient care. The system supports remote monitoring, which is particularly useful during situations like pandemics or in rural areas where healthcare facilities are limited. By using the Raspberry Pi 3 Model B+ and integrated sensors, the system ensures continuous observation of vital parameters without the need for constant manual supervision. Overall, this project demonstrates how modern technology can overcome the limitations of traditional healthcare methods and enable a more efficient, responsive, and data-driven approach to patient monitoring.

II. LITERATURE REVIEW

2.1 Introduction

The rapid growth of healthcare technology has played a major role in transforming the way medical services are delivered and managed. In recent years, smart patient monitoring systems have gained significant importance because they help improve the efficiency, accuracy, and quality of healthcare services. Traditional patient monitoring methods mainly depend on manual observation by healthcare staff, where vital signs are checked periodically. Although these methods are widely used, they are often time-consuming, labor-intensive, and vulnerable to human errors. In emergency situations, delays in identifying abnormal health conditions can lead to serious complications and may even become life-threatening. As the number of patients suffering from chronic diseases continues to increase, along with the growing elderly population, healthcare systems are facing challenges in providing continuous and effective monitoring to every patient.

To overcome these limitations, the healthcare industry has increasingly adopted Internet of Things (IoT)-based technologies and embedded systems for patient monitoring. IoT enables medical devices and sensors to communicate with each other and exchange data over networks in real time. Smart monitoring systems use biomedical sensors to continuously measure important physiological parameters such as heart rate, body temperature, blood oxygen saturation (SpO₂), and electrocardiogram (ECG) signals. These sensors collect patient data continuously and transmit it to a processing unit such as the Raspberry Pi 3 Model B+, where the information is analyzed and displayed. Continuous monitoring helps in detecting abnormalities at an early stage, allowing healthcare professionals to respond quickly and provide timely treatment.

Another major advantage of smart healthcare systems is their ability to support remote patient monitoring. Through wireless communication technologies such as Wi-Fi and Bluetooth, patient data can be transmitted to cloud platforms, mobile applications, or web interfaces. This allows doctors, caregivers, and family members to monitor the patient's condition from remote locations without requiring constant physical presence. Remote healthcare solutions are especially beneficial in rural areas, home-care environments, and

situations where access to hospitals is limited. They also reduce the workload on healthcare professionals by automating routine monitoring tasks and minimizing manual record-keeping. Recent studies in this field have explored the integration of sensor networks, embedded systems, cloud computing, and mobile technologies to create advanced patient monitoring platforms. Researchers have focused on improving the accuracy of biomedical sensors, reducing power consumption, enhancing communication reliability, and ensuring secure handling of patient data. Data privacy and security remain critical concerns because medical information is highly sensitive and must be protected from unauthorized access. In addition, many studies emphasize the importance of real-time alert systems that can notify caregivers immediately whenever abnormal health conditions are detected.

2.2. Review of literature

1. IoT-Based Healthcare Monitoring System towards Improving Quality of Life

Year: 2025

Published In: International Journal of Electrical and Computer Engineering (IJECE)

Summary:

The paper discusses an IoT-based healthcare system for real-time monitoring of patient health parameters and improving patient care through remote access and early detection.

2. Systematic Review of Smart Health Monitoring Using Deep Learning and Artificial Intelligence

Year: 2025

Published In: Journal of Healthcare Engineering

Summary:

This review explains how AI and deep learning improve smart healthcare systems by enhancing prediction accuracy and automated patient monitoring.

3. IoT-Based Smart Health Monitoring System: Investigating the Role of Temp, Blood Pressure

Year: 2025

Published In: International Journal of Advanced Computer Science and Applications (IJACSA)

Summary:

The study presents an IoT-based system for monitoring temperature and blood pressure using sensors and wireless communication technologies.

4. Smart Health Monitoring Using Deep Learning and Artificial Intelligence

Year: 2024

Published In: International Research Journal of Engineering and Technology (IRJET)

Summary:

The paper focuses on using AI and deep learning techniques for accurate health monitoring and early disease detection.

5. An Independent Audit Framework for Software Dependent Voting Systems

Year: 2003

Published In: ACM Conference on Computer and Communications Security (CCS)

Summary:

This paper proposes a secure audit framework for improving reliability and transparency in software-based electronic systems.

2.3 Research Gapes

Health Parameters – Most systems monitor only basic vitals and lack advanced metrics are Blood pressure, oxygen level, or temperature.

Connectivity Dependency – Dependence on stable internet makes it unreliable in low-connectivity areas.

Power and Portability Limitations – Wearable devices have limited battery life, reducing their usability for continuous long-term monitoring.

2.4 Problem Statement

The project aims to develop an Medi track System that reliably transmits real-time sensor data, enables continuous monitoring of vital signs, sends instant alerts for abnormal conditions, and provides graphical visualization of patient data for easy analysis and timely medical decision-making.

2.5 Objectives

1. To develop a real-time patient monitoring system that continuously tracks vital health parameters such as heart rate, body temperature, oxygen saturation, and motion.
2. To implement a wireless communication system that enables remote access and transmission of patient data to healthcare professionals and caregivers.
3. To implement a wireless communication system that enables remote access and transmission of

patient data to healthcare professionals and caregivers.

- To ensure data security and reliability by incorporating secure storage, encryption, and system stability to maintain the integrity and privacy of patient health information.

2.6 Closure

In conclusion, the Medi-Track System offers a promising solution to many challenges faced in modern healthcare, including delayed responses, limited access to real-time data, and high dependency on manual monitoring. By leveraging IoT technology, wireless communication, and automated alerts, the system enhances patient safety, supports remote care, and reduces the workload on healthcare professionals. While certain challenges such as data privacy and power efficiency remain, this project lays the foundation for future advancements in intelligent, connected healthcare solutions. Continued development and integration of such systems can significantly improve the quality, efficiency, and accessibility of medical care.

Survey of Project



Fig 1.1: Bhavani Hospital: Dr. Omprakash Todkari

Survey Suggestion

Doctors stated that real-time monitoring of heart rate, SpO₂, temperature, and ECG helps in early detection of health problems and improves patient care. They also found remote monitoring and alert systems useful for faster medical response. The doctors suggested improving sensor accuracy, adding mobile application

support, and including emergency alert features for better healthcare monitoring.

III. METHODOLOGY

3.1 Introduction

The development of the Medi Track System follows a structured methodology to ensure a reliable and efficient patient monitoring solution. The process begins with defining system requirements, including the selection of appropriate sensors for measuring vital parameters such as heart rate, blood oxygen saturation (SpO₂), body temperature, and ECG signals. These sensors are interfaced with the Raspberry Pi 3 Model B+, which serves as the central unit for data processing and control. The collected data from sensors is processed and displayed in real time on a 3.5-inch screen, providing immediate feedback to users. For remote monitoring, the system utilizes built-in Wi-Fi connectivity to transmit data to online platforms, allowing access through mobile devices or web interfaces. An alert mechanism is incorporated to activate a buzzer whenever any parameter exceeds predefined threshold values, ensuring quick response during critical conditions. The methodology also considers system reliability and usability by organizing proper hardware integration and maintaining stable communication between components. The development process includes repeated testing and validation to ensure accurate sensor readings and smooth system performance. Continuous improvements and optimization are carried out to enhance the overall functionality, making the system suitable for effective patient monitoring in both clinical and home environments.

3.2 Methodology details

The initial stage in developing the Medi Track System involves identifying both functional and non-functional requirements. This includes deciding which vital parameters need to be monitored, such as heart rate, blood oxygen saturation (SpO₂), body temperature, and ECG signals. Other factors like alert response time, system reliability, and data transmission capability are also considered. Based on these requirements, the overall system architecture is planned, ensuring proper integration of sensors, processing unit, display module, and communication interface for efficient data handling.

Selection of Sensors and Hardware Components: After defining the requirements, suitable sensors and hardware components are selected. The system incorporates the MAX30102 Pulse Oximeter Sensor for measuring heart rate and oxygen saturation, the DS18B20 Temperature Sensor for accurate body temperature sensing, the DHT11 Sensor for monitoring environmental conditions, and the AD8232 ECG Sensor for capturing ECG signals. All these sensors are interfaced with the Raspberry Pi 3 Model B+, which processes the collected data and converts it into a usable digital format for display and transmission.

1. **Real-Time Data Processing and Analysis:** Once data is transmitted, it is processed and analyzed on the cloud or through a mobile app. A threshold-based system is implemented to continuously monitor vital signs. If any parameter falls outside the predefined safe range, an alert mechanism is triggered, notifying healthcare providers through notifications, SMS, or emails to ensure prompt medical intervention.
2. **Alert Mechanism and Notifications:** The system is equipped with a built-in alert system that activates when the patient's vital signs deviate from their normal ranges. These alerts can be sent to medical staff, caregivers, or family members via SMS, mobile app notifications, or email. The system allows for customizing alert thresholds depending on patient conditions and healthcare settings.
3. **Hardware Implementation:** Ensuring the security and privacy of patient data is a critical part of the methodology. Data encryption is employed to protect sensitive health information during transmission. The system complies with data protection standards like HIPAA (Health Insurance Portability and Accountability Act) or GDPR (General Data Protection Regulation), ensuring that patient information is securely stored and shared.
4. **Testing and Validation:** The system underwent rigorous testing and validation procedures to assess its performance under various conditions. Testing included simulated environmental scenarios, user interaction testing, and stress testing to identify and address potential issues.

3.3 Block Diagram

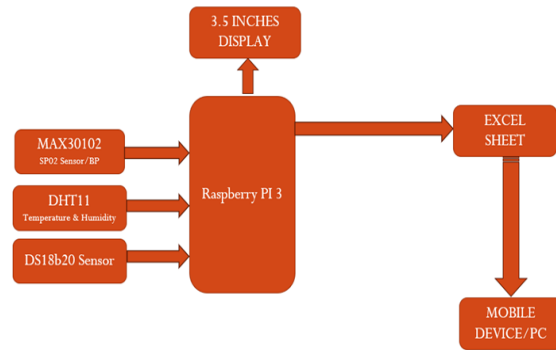


Fig 1.2: Connection of Sensor to Raspberry pi micro-controller and display it on various devices

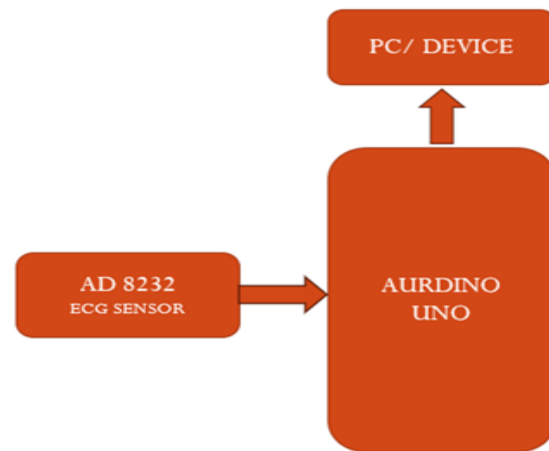


Fig 1.3: Connection of ECG sensor to Arduino uno

3.4 Component Selection

The Raspberry Pi 3 Model B+ is a powerful and cost-effective single-board computer widely used in IoT and embedded system applications. It offers sufficient processing capability to run a full operating system while supporting multiple tasks simultaneously. With built-in Wi-Fi and Bluetooth connectivity, it can easily connect to networks and communicate with other devices for data transfer and remote monitoring.

The Raspberry Pi provides a variety of interfaces, including GPIO pins, USB ports, HDMI output, and support for communication protocols such as I2C, SPI, UART, and 1-Wire. This makes it highly suitable for interfacing with sensors, displays, and other hardware components used in monitoring systems.

Due to its flexibility, ease of programming using languages like Python, and strong community support,

the Raspberry Pi is commonly used in applications such as IoT systems, automation, robotics, and healthcare monitoring. Its ability to handle data processing, visualization, and communication makes it an ideal choice for real-time systems like smart patient monitoring solutions, where continuous data collection and analysis are required.

DHT sensor serves as a multifunctional component for monitoring environmental parameters crucial for plant health. The DHT sensor is capable of measuring both temperature and humidity levels in the surrounding environment. Temperature fluctuations can impact plant metabolism, growth rates, and overall health. By monitoring temperature levels, the system can ensure that plants are kept within optimal temperature ranges for growth and development.

MAX30102 is a low-power optical sensor module that measures SpO₂ (blood oxygen level) and heart rate using integrated red and IR LEDs, offering around ±2% SpO₂ accuracy and ±3 BPM heart-rate accuracy for real-time health monitoring.

DS18B20 Temperature Sensor is a digital temperature sensor that provides high- accuracy measurements using a 1-Wire communication protocol, offering up to ±0.5°C accuracy over a wide range, making it suitable for real-time body temperature monitoring in healthcare applications.

3.5 Closure

In summary, the structured methodology guided the systematic development and implementation of the smart monitoring system of patients, ensuring thorough research, iterative design, rigorous testing, and documentation. This approach facilitated the creation of a reliable and user-friendly solution, laying the foundation for future advancements in automated plant care technology.

IV. RESULTS AND DISCUSSIONS

4.1 Introduction

In this project, we have discussed the design and implementation of the Medi Track System, which focuses on automated monitoring of vital health parameters. This section presents a detailed analysis and interpretation of the obtained results. It highlights system performance, accuracy of sensor readings, and observations recorded during testing and validation. The discussion also reflects how effectively the system

monitors parameters such as heart rate, body temperature, blood oxygen saturation (SpO₂), and ECG signals in real time. Furthermore, this section evaluates the strengths and limitations of the system by comparing practical outcomes with expected results and theoretical concepts. It also considers the reliability of data processing performed by the Raspberry Pi 3 Model B+ and the effectiveness of the alert mechanism in identifying abnormal conditions. The significance of the results is emphasized in terms of improving patient monitoring and supporting timely medical response.

In addition, this section provides an overview of key findings and their impact on the development of smart healthcare solutions. It aims to offer a clear understanding of the system's overall performance while preparing the reader for the final conclusions and future scope of the project.

4.2 Key points in Results and Discussion

- Detailed assessment of the system's performance metrics, including accuracy of sensor readings, efficiency of watering schedules, and responsiveness to environmental changes.
- Analysis of user feedback regarding system interface, customization options, and overall user experience, highlighting strengths and areas for improvement.
- Examination of the system's impact on plant health and growth, considering factors such as hydration levels, nutrient uptake, and overall vitality.
- Comparison of the automated system with traditional manual watering methods and existing automated solutions, showcasing advantages and limitations.
- Discussion on the system's energy consumption, water usage efficiency, and sustainability implications in the context of environmental conservation.
- Assessment of the system's scalability and adaptability to different plant types, growing environments, and user preferences, exploring opportunities for future enhancements.
- Exploration of the practical implications and real-world applications of the automated system in diverse settings, including residential gardening, urban agriculture, and commercial horticulture.

Results

	Timestamp	A	B	C	D	E
656	13/04/2026 15:52:32	35.6	35	0	0	0
657	13/04/2026 15:52:48	35.6	35	0	0	0
658	13/04/2026 15:53:05	35.6	35	0	0	0
659	13/04/2026 15:53:25	35.6	35	0	0	0
660	13/04/2026 15:53:44	35.6	35	0	0	0
661	13/04/2026 15:54:02	35.6	35	0	0	0
662	13/04/2026 16:27:06	35.2	38	0	0	0
663	13/04/2026 16:27:20	35.2	38	0	0	0
664	13/04/2026 16:27:42	35.2	38	75	91	91
665	13/04/2026 16:28:19	35.2	39	75	91	91
666	13/04/2026 16:28:36	35.2	38	75	91	91
667	13/04/2026 16:28:50	35.2	39	75	91	91
668	13/04/2026 16:29:04	35.2	39	75	91	91
669	13/04/2026 16:29:18	35.2	39	75	91	91
670	13/04/2026 16:29:33	35.2	39	75	91	91
671	13/04/2026 16:29:48	35.2	39	75	91	91
672	13/04/2026 16:30:02	35.2	39	75	91	91
673	13/04/2026 16:30:18	35.2	39	75	91	91
674	13/04/2026 16:30:32	35.2	39	75	91	91
675	13/04/2026 16:30:47	35.2	39	75	91	91
676	13/04/2026 16:31:02	35.2	39	75	91	91
677	13/04/2026 16:31:16	35.2	39	75	91	91
678	13/04/2026 16:31:31	35.2	39	75	91	91

Fig 1.4: Real-Time reading of patient monitoring



Fig 1.5: Application reading on web server

V. CONCLUSION AND FUTURE SCOPE

5.1 In conclusion, the Medi Track System represents a meaningful step forward in modern healthcare monitoring by providing a proactive and efficient solution for patient care. By integrating IoT-based sensing, real-time data processing, and automated alert mechanisms, the system improves the accuracy and responsiveness of health monitoring. It enables early identification of abnormal conditions, which can support timely medical intervention and better patient outcomes, while also reducing the burden on healthcare professionals. The use of the Raspberry Pi 3 Model B+ along with multiple biomedical sensors ensures reliable data collection and continuous monitoring in both clinical and home environments. The system is designed with simplicity and usability in mind, making it accessible for a wide range of users. Looking ahead, the system can be further enhanced by incorporating advanced technologies such as artificial

intelligence and machine learning for predictive analysis, as well as improved connectivity and integration with healthcare platforms. Overall, the project demonstrates the potential of smart, technology-driven solutions in improving the quality, accessibility, and efficiency of healthcare services.

5.2 Future Scope

The Medi Track System offers significant opportunities for future enhancement and expansion. One important direction is the integration of artificial intelligence (AI) and machine learning techniques to improve the analysis of patient data. By applying these methods, the system can identify patterns, forecast potential health risks, and support personalized healthcare recommendations, thereby making patient monitoring more predictive and proactive.

Another area of development is the inclusion of wearable devices such as smartwatches and fitness trackers. These devices can continuously collect additional health-related data, including activity levels, sleep patterns, and stress indicators, without causing inconvenience to the user. Integrating such data with the central system powered by the Raspberry Pi 3 Model B+ would enable a more comprehensive and continuous assessment of patient health.

Further improvements may include enhanced cloud connectivity, mobile application support, and secure data sharing with healthcare professionals. Overall, these advancements can transform the system into a more intelligent, scalable, and user-friendly healthcare solution suitable for modern medical needs.

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The paper focuses on using AI and deep learning techniques for accurate health monitoring and early disease detection.

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Year: 2007
Published In: ACM Conference on Computer and Communications Security (CCS)
This paper proposes a secure audit framework for improving reliability and transparency in software-based electronic systems

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APPENDIX I

Cost Sheet

Sr. No.	Particular	Amount (Rs.)
01	ECG SENSOR	375
02	JUMPER WIRES	70
03	3.5” LED DISPLAY	1500
04	DHT 11	90
05	10,000mah Power Bank	1500
06	MAX 30102	150

07	RASPBERRY PI 3 B+	3800
08	MICROSD CARD	1500
09	DS18B20	90
	Total	8475/-

APPENDIX II

Project Based Awards and Achievements (If Any)
 The student needs to attach the testimonials of the achievement obtained for the project work at the end of the Appendix II.

List Of Publications
 The students need to write the publications details in IEEE format and attach the entire paper in the final report for the same. Applied

APPENDIX III

Project Based Outcomes
 The student needs to fill the below table for the outcomes they have gained during the work. These outcomes will vary based on Project Based Learnings.

Outcomes	Agree (1)	Moderately (2)	Highly Agree (3)
1. Engineering knowledge: Apply the knowledge of mathematics science engineering fundamentals and a mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems engineering problems.			
2. Problem analysis: Identify,			

formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.			
3. 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			
4. 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			
5. Modern tool usage: Create, , select, and apply			

appropriate techniques, resources, and modern engineering and IT tools including and modelling to complex engineering activities with an understanding of the limitations			
6. The engineer and society: Apply reasoning informed by Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice			
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development and need for sustainable development.			

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice			
9. Individual and team work: Function effectively as an individual and as a member or leader in diverse teams and individual, and as a member or leader in diverse teams, and in multidisciplinary settings			
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, and write effective reports and design documentation, make effective presentations, and give and receive clear instructions			
11. Project management and finance: Demonstrate			

<p>knowledge and understanding of the engineering and knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.</p>			
<p>12. Life-long learning: Recognize the need for and have the Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change</p>			