SUGGESTED AREAS OF RESEARCH/RESEARCH TOPICS

A. Selection of Research Topic/Project

Kindly select a research topic from the list provided below:

1. **Development of sensors for smart city applications such as traffic management systems, smart parking, smart grid, smart homes, smart institutions and smart network management.**

- Innovative Smart city applications for broadband penetration. Areas including but not limited to smart parking, smart grid, smart home, smart institutions, smart network management etc.

Use Case

- Smart network management: This could include applications such as network optimization tools for improving efficiency and capacity, as well as cybersecurity solutions for protection against threats.
- Smart parking: This could include applications such as real-time parking availability information, dynamic pricing for parking spots, and smart parking garages with automated vehicle guidance.
- Smart grid: This could include applications such as real-time monitoring and control of electricity distribution, integration of renewable energy sources, and demand response systems for managing energy usage.
- Smart public services: This could include applications such as online portals for accessing government services, as well as connected systems for managing public utilities and infrastructure.
- Public safety and emergency response: This could include applications such as connected cameras for public surveillance, emergency notification systems, and real-time crime mapping tools.

2. Use of Telecommunication networks in Identity Management and Location Tracking via National Identity Numbering (NIN) and Artificial Intelligence.

- Design and development of a system to track, locate, and monitor operations using the National Identity Number.

Use Case

- Identity verification and authentication: This could include research on how to use National Identity Numbering (NIN) and other identity information in combination with artificial intelligence (AI) and machine learning algorithms to accurately verify the identity of users.

- Location tracking and privacy: This could include research on how to use telecommunication networks and AI to track the location of users in a way that respects their privacy and complies with relevant regulations.
- Integration with other systems: This could include research on how to integrate NIN and location tracking capabilities with other systems, such as financial transactions, transportation networks, and emergency services, in order to provide a seamless and secure user experience.

3. Design and implementation of efficient solar mobile phone/battery charger.

- Design and development of an effective solar charger to provide a clean alternative to the regular high carbon emitting sources of energy.

Use case

- Solar charger for electric vehicles: This project could focus on developing a solar charger that is capable of charging electric vehicles, such as electric cars and e-bikes. The charger could be designed with a high-capacity battery and a fast charging capability, as well as a durable and weather-resistant enclosure.
- Solar-powered home energy system: This project could focus on developing a comprehensive solar-powered energy system for homes. The system could include a large solar panel array, a battery storage system, and an inverter for converting the direct current (DC) electricity generated by the panels into alternating current (AC) electricity that can be used by household appliances. The system could also include a smart energy management system for optimizing energy usage and minimizing waste.
- Solar-powered drone charging station: This project could focus on developing a solar-powered charging station for drones that is able to recharge the batteries of multiple drones simultaneously. The station could be designed with a solar panel array, a battery storage system, and multiple charging ports. It could be used in a variety of applications, such as agricultural surveying, search and rescue, and environmental monitoring.

4. Research leading to commercial production of high capacity battery for telecommunications equipment.

- Development of an effective high capacity battery to provide an alternative source of power for telecommunications equipment.

Use Case

- Solar-powered portable generator: This project could focus on developing a portable solar generator that is able to produce electricity from sunlight and store it in a battery. The generator could be designed with a rugged, weather-resistant enclosure and multiple outlets for powering various types of electronic devices. It

could be used in a variety of settings, such as outdoor events, construction sites, and disaster relief efforts.
- Solar-powered off-grid microgrid: This project could focus on developing a small-scale, decentralized energy system that uses solar panels and batteries to provide electricity to a community or group of households that are not connected to the grid. The microgrid could be designed to be scalable, so that it can be easily expanded as the energy needs of the community grow.

5. Design and implementation of an Artificial Intelligence based predictive maintenance solutions for telecommunications infrastructure.

- AI-driven predictive systems with robust algorithms, and machine learning techniques to predict the future condition of telecoms infrastructure based on historical data and trends. Operators can use data-driven insights to monitor the state of equipment and anticipate failures to proactively fix problems of telecommunications hardware.

Use Case

- Predictive maintenance for telecom towers: This project could focus on developing an AI-based system for predicting when telecom towers will require maintenance, such as inspections, repairs, or upgrades. The system could analyze data from sensors on the towers, as well as external data sources, such as weather patterns, to identify potential issues and schedule maintenance before problems occur.
- Predictive maintenance for telecom switching equipment: This project could focus on developing an AI-based system for predicting when telecom switching equipment, such as routers and switches, will require maintenance. The system could analyze data from sensors on the equipment, as well as data from the equipment's performance logs, to identify potential issues and schedule maintenance before problems occur.
- Predictive maintenance for telecom cables: This project could focus on developing an AI-based system for predicting when telecom cables will require maintenance, such as repairs or replacements. The system could analyze data from sensors on the cables, as well as data from the cables' performance logs, to identify potential issues and schedule maintenance before problems occur.

6. Development of smart intrusion detection and alarm systems to curb theft vandalization of telecommunications infrastructure.

- The impact of vandalism of infrastructure is felt by all in the quality of services rendered as it results in increasing drop calls, data and internet connectivity disruptions, aborted and undelivered short messaging services (SMS), as well as countless failed calls. It is essential to research and proffer solutions on smart intrusion detection and alarm systems to curb theft and vandalism of telecoms infrastructure. Continuous improvement on this would immensely support good delivery of QoS.

Use Case

- Video surveillance and analysis: This project could focus on developing a video surveillance system that uses artificial intelligence (AI) to analyze video footage in real-time and detect potential intrusions or vandalism. The system could use image recognition algorithms to identify people, vehicles, and objects, as well as behavioral analysis algorithms to identify suspicious activity.
- Sensor-based intrusion detection: This project could focus on developing a sensor-based intrusion detection system that uses sensors, such as motion detectors, to detect potential intrusions or vandalism. The system could be designed to be resilient to false alarms and to provide accurate location information for response purposes.
- Wireless sensor networks: This project could focus on developing a wireless sensor network for monitoring telecommunications infrastructure. The network could consist of small, low-power sensors that are deployed at strategic locations and that communicate with a central hub using wireless technology. The sensors could be used to detect intrusions, measure environmental conditions, and perform other types of monitoring.

7. Development of Cybersecurity solutions to curb cyber-attacks.

- Telecommunication operators handle essential infrastructure, therefore a cyber-attack can have a huge and far-reaching impact. This should proffer cybersecurity solutions to protect all the users from infected files, malware, and digital attacks which lead the users to access private sensitive information of users.

Use case

- Machine learning-based intrusion detection: This project could focus on developing a machine learning-based system for detecting cyber-attacks in real-time. The system could analyze network traffic data and use patterns and anomalies to identify potential attacks, and then alert security personnel or take automated countermeasures.
- Cybersecurity risk assessment and management: This project could focus on developing a framework for assessing and managing cybersecurity risks, including identifying vulnerabilities, evaluating the likelihood and impact of potential attacks, and implementing appropriate controls.
- Secure software development: This project could focus on developing best practices and tools for securely designing, building, and testing software, in order to reduce the likelihood of vulnerabilities being introduced into systems. This could include techniques such as code review, static analysis, and penetration testing.

B. Writing a Proposal

Having selected a topic from the above list, you are required to follow this guideline to prepare a proposal describing the project objectives and how you plan to achieve the objectives. The proposal must contain the following:

Project Topic
Select a preferred topic from the list provided.

Student's name and matriculation number
Provide your name (starting with first name, then middle name and end with last name) and matriculation number, both in capital letters.

Abstract
The Abstract should be brief (100 to 200 words in length), self-explanatory and provide a clear statement of the problem, the proposed approach or solution, and point out major findings and conclusions. In other words, it is the WHAT, HOW and WHY of the project. No literature should be cited in the Abstract.

Introduction [max. 1000 words]
This section introduces the subject matter and problem being investigated. It also contains information on the significance of the study, motivation, main aim and objectives, methodology (the practical approaches) intended to employ to solve the problem, and the scope of the project (if applicable). The Introduction should be supported with facts

Problem Statement [max. 200 words or 2 paragraphs]
This explains the problem that the project will address. It describes an undesirable gap or drawback of the current situation which the project intends to address.

Aim and objectives [max. 200 words]
While aim is a statement of intent which includes a description of motivations for undertaking the project, objectives relate to the specific expected outcomes of the project.

Purpose and Relevance of the Project [max. 200 words]
The goals and relevance of the project should be clearly defined in this section. Practical reasons why the project is important should be provided. Where necessary, students should state the hypothesis that needs to be tested and questions that are to be answered by their research project. The first paragraph of this (sub)section should begin with statement such as: "the purpose of this study is…". While the last paragraph should explain clear relevance of the project to the telecommunications industry.

Literature Review
[min. 20 review papers, include meta table as necessary; max. 1500 words]

This section is about a critical review of related previous scientific works on the project **to bring out clearly the novelty of the research**. It is subdivided into Theoretical Background and Related Works. Historical background may be provided, while student must state the current achievements in the specific field of research.

The significance of literature review is to evaluate existing works vis-à-vis the current work. Literature review gives insights to understanding the problems and limitations of the previous studies or projects.

Significant part of references is usually found in Literature Review section. High number of references is an indication of wider search and knowledge of the student on the project topic. It is important to use only sources from peer-reviewed journals and credible books.

Methodology [max. 200 words]
This section is an overview of the materials and methods, including research design, research calculations, and research procedure (in the form of algorithms, codes, flowcharts, block diagrams, etc.). The section also discusses data acquisition, the methods to be used to prove the research hypothesis and the important variables for test in order to prove the hypothesis' validity. The description in this section can be supported with appropriate references.

Proof of Concept [max. 200 words]
This involves feasibility of idea with diagram, algorithm, etc.

Tangible Output
A tangible output such as a prototype/software or working model which can be commercialized is to be presented here. A roadmap from innovative prototype to commercialization of the prototype should be provided.

Timeline
The periods that students intend to devote to their projects are contained here. Research project activities with timeline, schedule, Gantt chart or milestones should be highlighted.

Cost Analysis
This involves a breakdown of costs and expenses to be incurred on the project. It includes the cost of materials, components, equipment and other important resources required.

References
The proposal should also contain detailed references. All the important sources should be cited in the proposal using APA format displaying sources (name of authors, title, date of publication, etc.). All references should be to the most pertinent and up-to-date sources. Only cited literatures should be referenced in the report.