ROBOTICS E.D.A DEVELOPMENT PROJECT (BELLS UNIVERSITY OF TECHNOLOGY-NEW HORIZONS)

PREPARED FOR

200 level Student Team

Bells University of Technology

Course Code: ICT215

Date: 26-Nov-2025

PREPARED BY

Ayuba Muhammad(Senior Software/AI Engineer)

New Horizons ICT

Dear Student Team,

Re: Enclosed Project Implementation Guidelines

Please find enclosed our detailed project implementation guidelines for your academic team's consideration.

At **Bells University of Technology - New Horizon ICT**, we understand that developing effective, real-world solutions requires a blend of technical skill and teamwork, along with a clear understanding of each team member's role. We encourage each student team to approach this project with dedication and collaboration, as the results will reflect our institution's standard of excellence.

Project Timeline: Each group is given one month from the release date of this project to complete their implementation. This time frame has been carefully designed to allow thorough development while building essential skills in problem-solving, coding, and team-based project management.

Each project must be published on **GitHub** with a detailed README.md and each member assigned as a contributor. Additionally:

- The team leader will be responsible for submitting the final GitHub link.
- Individual members should also fork the repository to showcase contributions.

Yours Truly,

Instructor.

TEAM

SUMMARY

This document provides detailed guidelines and requirements for the Robotics EDA Development Project assigned to student teams across the Engineering Departments.

Each student group is expected to deliver a complete, original, and deployable software solution using Proteus and Arduino frameworks. The guidelines within outline the expectations, timelines, and collaborative tools required to ensure a successful project outcome.

ICT 215 – Robotics and Embedded Systems

OFFICIAL PROJECT HANDBOOK & TEMPLATE FOR STUDENTS
(2025/2026 Session)

(Prepared by the Course Lecturer – To be distributed to all students)

1. COURSE TITLE

ICT 215 – Robotics and Embedded Systems

2. PROJECT OBJECTIVE

Design, simulate and implement(optional) functional robotic systems integrating sensors, actuators, and microcontroller programming using Proteus, Tinkercad and Arduino.
Workflow (must appear in your report):

Proteus circuit design and simulation → Arduino Code Development → Hardware Integration → Debugging & Optimization → Documentation & GitHub Upload

3. COMPULSORY REQUIREMENTS (NON-NEGOTIABLE)

- Full analog circuit design (sensor interfacing, signal conditioning, power supply, etc.)
- Microcontroller-based system (Arduino, ESP32, STM32, PIC – your choice)
- Complete simulation in Proteus AND Tinkercad
- Professional PCB design (EasyEDA, KiCad, Altium, or Eagle)
- Physical prototype: breadboard → custom PCB → final working robot
- Public GitHub repository with all members as contributors

4. APPROVED DEFAULT TOPICS BY DEPARTMENT (Choose ONLY ONE)

Department	Approved Topics (Select One Only)

Mechatronics Engineering	1. Line Following Robot 2. Obstacle Avoidance Robot 3. Smart Dustbin 4. Voice-Controlled Robot 5. Weather Monitoring Robot
Biomedical Engineering	1. Autonomous Delivery Robot 2. Agricultural Robot for Smart Farming 3. Robotic Arm for Assembly Line Automation 4. Swarm Robotics for Search and Rescue 5. Humanoid Robot for Human Assistance
Electrical & Electronics / Telecom Engineering	1. Surveillance Robot with Camera and Sensors 2. Terrain Mapping Robot 3. Robotic Cleaner for Urban Spaces 4. Telepresence Robot 5. Gesture-Controlled Robot
Computer Engineering	1. Automatic Street Light System 2. Smart Temperature & Humidity Monitor 3. Motion Detector Alarm System 4. Maze Solving Robot 5. Smart Irrigation System
Mechanical Engineering	1. Assistive Tech for Blind / Smart Blind Stick 2. Human Following Robot 3. Sun Tracking Solar Panel 4. Smart Entry-Exit System 5. Smart Shopping Cart System

Custom Topic Rule: Submit a one-page proposal for approval at least before starting. Custom topics must still meet all compulsory requirements.

5. OFFICIAL REPORT STRUCTURE (Chapter 1 to Chapter 5 – Must follow exactly)

CHAPTER 1: INTRODUCTION

1.1 Background of the Study
1.2 Problem Statement
1.3 Objectives

General Objective: To design, simulate, prototype, and implement a functional robotic system integrating analog circuits, sensors, actuators, and microcontroller programming.

Specific Objectives (minimum 6):

1. To design and simulate the complete system using Proteus and Tinkercad
2. To develop analog circuits for sensor interfacing and signal conditioning
3. To write and optimize microcontroller code for real-time control
4. To design a professional PCB layout
5. To build and test the physical prototype
6. To document the entire project and publish on GitHub

1.4 Research Questions
1.5 Significance of the Study
1.6 Scope and Limitations

1.7 Organization of the Study

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction
2.2 Review of Existing Similar Robots (minimum 8–10 references)
2.3 Analog Circuit Techniques in Robotics
2.4 Microcontroller Selection and Justification
2.5 Use of Proteus and Tinkercad in Industry/Education
2.6 PCB Design Trends in Robotics

2.7 Research Gap Identification

CHAPTER 3: METHODOLOGY (MOST IMPORTANT CHAPTER)

3.1 System Block Diagram
3.2 Hardware Design
  3.2.1 Analog Circuit Design (full explanation required)
  3.2.2 Microcontroller Selection & Pin Mapping
  3.2.3 Complete Schematic in Proteus
  3.2.4 Simulation Results in Proteus
  3.2.5 Tinkercad 3D Simulation

3.3 PCB Design (screenshots of layout, routing, Gerber files)
3.4 Software Development (flowchart + full code in appendix)
3.5 Prototype Development (step-by-step photos)
3.6 Testing and Validation Procedure

3.7 Ethical & Safety Considerations

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Simulation Results (Proteus & Tinkercad screenshots)
4.2 Hardware Results (tables, graphs, photos, video links)
4.3 PCB Performance Comparison (breadboard vs custom PCB)
4.4 Discussion of Findings (compare with literature)

4.5 Problems Encountered and Solutions

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings
5.2 Conclusion
5.3 Recommendations (industry + future students)
5.4 Contribution to Knowledge
5.5 Limitations

5.6 Suggestions for Future Work

References (IEEE or APA)

Appendices (Code, Schematics, PCB files, Photos, GitHub link, etc.)

6. FINAL SUBMISSION CHECKLIST (What I will mark)

- Chapter 1–5 properly structured
- Full analog circuit design with explanation
- Proteus + Tinkercad simulations included
- Professional PCB designed (Gerber files submitted)
- Physical working prototype (live demo compulsory)
- Public GitHub repository with excellent README.md and all members added
- Plagiarism < 15% (Turnitin report attached)
- Proper referencing
- Hard copy + PDF + GitHub link submitted on time

7. PERMITTED & PROHIBITED PRACTICES

Do’s

- Use AI only for code debugging and understanding errors
- Take inspiration from journals, YouTube, GitHub (cite them)

Don’ts

- Do not submit AI-generated reports (automatic zero)
- Do not copy-paste code or circuits without understanding
- Do not submit only simulation – physical system is optional

8. DEADLINES (Strict)

- Topic selection & group formation: Week 7
- Chapter 1–3 submission (draft): Week 8
- Final report + prototype demo: Week 9
- Viva/presentation: Week 10

This document is your complete project guide.

Follow it exactly and you will be happy.

Any questions? Ask in class or via the course WhatsApp group.

Good luck and start building!