

**ADMINISTRATION OF TSS LEVEL V NATIONAL PRACTICAL EXAMINATIONS, SCHOOL YEAR 2024/2025**

**FROM 19th May to 28th May 2025**

**REPORT OF THE OVERALL ACTIVITY**

**DISTRICT: NGORORERO**

**EXAMINATIONS CENTRE: ESECOM RUCANO**

1. **Introduction**

The Integrated Assessment for the Motion Sensing and Detection System at KILIKU Cement Limited is designed to evaluate learners' practical skills and knowledge in developing real-world IoT (Internet of Things) solutions for industrial security challenges. Located in Bugarama, Rusizi District, Western Province of Rwanda, KILIKU Cement Limited faces persistent issues related to the security of its manufactured cement products, particularly theft occurring due to weak physical security measures. To address this concern, the company seeks a technological intervention that combines electronic sensing and automated response mechanisms.

This assessment simulates a real industrial scenario where candidates are required to develop a proximity-triggered LED system to monitor movement at the company’s entrance. It integrates multidisciplinary competencies, including electronics circuit design, Arduino programming, database creation and management, and the development of a web-based monitoring interface. Candidates are expected to perform tasks such as identifying and assembling the required hardware components, designing and simulating the circuit using PROTEUS software, coding the detection logic on an Arduino microcontroller, establishing a communication link with a MySQL database, and building a PHP web interface for viewing motion detection logs.

The ultimate goal of the assessment is to enable learners to demonstrate their ability to analyze security problems, apply IoT technologies, and implement a fully functional, end-to-end system that enhances product security in an industrial context. Through this integrated task, learners not only strengthen their technical skills but also gain experience in solving real-world challenges using innovative and practical solutions.

1. **Objectives of the integrated assessment**

The integrated assessment aims to evaluate a candidate’s ability to solve a real-world problem using an Internet of Things (IoT) approach. The core objective is to develop a proximity-based Motion Sensing and Detection System to help KILIKU Cement Limited in Bugarama secure its products from theft. The assessment begins with the analysis of the company's existing security challenges and the identification of IoT as a viable solution to enhance physical product protection.

Participants are expected to apply core IoT engineering skills to design and assemble a system that uses an ultrasonic sensor and colored LEDs to indicate the proximity of an object approaching the company gate. Circuit simulation and design must be carried out using PROTEUS software to validate the system's wiring and component connections. Candidates will also write an Arduino program that accurately detects object distance and activates the appropriate LED (red, green, or blue) with specific delay timings.

In addition to hardware programming, the project requires the setup of a MySQL database (Motion\_db) to store real-time motion detection data. This involves creating a data bridge between the Arduino microcontroller and the database using a Python script to capture and store distance readings. The integration is extended further with the development of a PHP-based web interface that retrieves and displays stored motion events for user review and monitoring.

Finally, the assessment verifies the end-to-end functionality of the complete system — from sensor activation, Arduino signal processing, data logging into the database, and real-time visualization through the web interface. Through this hands-on project, participants demonstrate their ability to combine electronics, embedded software, database integration, and web development to build a comprehensive IoT security solution tailored to industrial needs.

1. **Candidates oriented at the examinations center**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **School of origin** | **Trade in full** | **Trade in short** | **Total number** | **Males candidate** | **Female candidates** | **% Males** | **% Females** |
| **ESECOM RUCANO** | **Networking and internet technology** | **NIT** | **57** | **21** | **36** | **36.84** | **63.16** |

1. **Private Candidates oriented at the examinations center**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **District of registration** | **Trade in full** | **Trade in short** | **Total number** | **Male candidates** | **Female Candidates** | **% Males** | **% Females** |
|  |  |  |  |  |  |  |  |

1. **Trainees’ Attendance (Participation)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Examinations Centre** | **Trainees’ School** | **Trade in short** | **Total assessed candidates** | **Number of male candidates** | **Number of female candidates** | **% Male** | **% Female** |
| ESECOM RUCANO | ESECOM RUCANO | NIT | 57 | 21 | 36 | 36.84 | 63.16 |
|  |  | **Total** | **57** | **21** | **36** | **36.84** | **63.16** |

1. **Private candidates’ attendance**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Examinations center** | **Option** | **Male** | **Female** | **Total** | **Total Oriented** | **% Male** | **% Female** | **Total % to Oriented** |
|  |  |  |  |  |  |  |  |  |

1. **Summary of the integrated assessment tasks**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trades** | **Description of Integrated assessment output (s)/ practical outcomes (what is expected to be achieved by the candidate? - Tasks** | **Level of Achievements** | | |
| **Total candidates present** | **Number of candidates who performed well the task (s)** | **% to the total assessed candidates** |
| **Networking and internet technologies (NIT)** | 1. Identify all the necessary Tools, materials and components for installing  this IoT System.  2. Design a wiring diagram for this scenario by using PROTEUS SOFTWARE.  3. Mount all necessary components on Breadboard.  4. Write an Arduino program to detect objects with using the logic below:  a) If the object is detected within 20 cm, LED1 should light up with a red  color.  ➢ Set LED number 1 with a 100 ms delay when turning it on and a  150 ms delay when turning it off.  b. If the object is detected within 25 cm, LED2 should light up with a green color.  ➢ Set LED number 2 with a 150 ms delay when turning it on and a 200  ms delay when turning it off.  c. If the object is detected within 35 cm, LED3 should light up with a blue  color  ➢ Set LED number 3 with a 200 ms delay when turning it on and a 250  ms delay when turning it off.  5. Create database named”Motion\_db”  • Create table named “Motion\_data”to store motion data with the  following attributes: Id, Motion\_Detected and timestamp  6. Set up communication between the Arduino and a database to store  data recorded  7. Develop a PHP-based web interface to view the event details from the  database.  8. Verify the end-to-end functionality from object detection to view data  on the web interface. | **57** | **10** | 17.54 |
| **Networking and internet technologies (NIT)** | 1. Identify all the necessary Tools, materials and components for installing this IoT System.  2. Design a wiring diagram for this scenario by using PROTEUS SOFTWARE.  3. Mount all necessary components on Breadboard.  4. Write an Arduino program to detect objects with using the logic below:  a) If the object is detected within 15 cm, LED1 should light up with a red color.   Set LED number 1 with a 300 ms delay when turning it on and a 200 ms delay when turning it off.  b) If the object is detected within 20 cm, LED2 should light up with a green color.   Set LED number 2 with a 400 ms delay when turning it on and a 300 ms delay when turning it off.  c) If the object is detected within 25 cm, LED3 should light up with a blue color   Set LED number 3 with a 500 ms delay when turning it on and a 400 ms delay when turning it off.  5. Create database named”Motion\_db”   Create table named “Motion\_data”to store motion data with the following attributes: Id, Motion\_Detected and  timestamp  TSS National Integrated Assessment 2024-2025 Page 3 of 14  6. Set up communication between the Arduino and a database to store data recorded  7. Develop a PHP-based web interface to view the event details from the database.  8. Verify the end-to-end functionality from object detection to view data on the web interface. | 47 | 10 | 21.27 |
| **Networking and internet technologies (NIT)** | 1. Identify all the necessary Tools, materials and components for installing  this IoT System.  2. Design a wiring diagram for this scenario by using PROTEUS SOFTWARE.  3. Mount all necessary components on Breadboard.  4. Write an Arduino program to detect objects with using the logic below:  a) If the object is detected within 30 cm, LED1 should light up with a red color.  ➢ Set LED number 1 with a 200 ms delay when turning it on and a  150 ms delay when turning it off.  b) If the object is detected within 20 cm, LED2 should light up with a green color.  ➢ Set LED number 2 with a 250 ms delay when turning it on and a 350  ms delay when turning it off.  c) If the object is detected within 10 cm, LED3 should light up with a blue  color  ➢ Set LED number 3 with a 300 ms delay when turning it on and a 450  ms delay when turning it off.  5. Create database named”Motion\_db”ESECOM RUCANODownloaded by HATEGEKIMANA DENIS CHRISTOPHE on Thu, 22 May 2025 08:34:17 CAT  TSS National Integrated Assessment 2024-2025 Page 3 of 13  • Create table named “Motion\_data”to store motion data with the  following attributes: Id, Motion\_Detected and timestamp  6. Set up communication between the Arduino and a database to store  data recorded  7. Develop a PHP-based web interface to view the event details from the  database.  8. Verify the end-to-end functionality from object detection to view data  on the web interface. | 37 | 10 | 27.02 |
| **Networking and internet technologies (NIT)** | Activities:  1. Identify all the necessary Tools, materials and components for  installing this IoT System.  2. Design a wiring diagram for this scenario by using PROTEUS SOFTWARE.  3. Mount all necessary components on Breadboard.  4. Write an Arduino program to detect objects with using the logic  below:  a) If the object is detected within 10 cm, LED1 should light up with a  red color.  ➢ Set LED number 1 with a 200 ms delay when turning it on and a  300 ms delay when turning it off.  b) If the object is detected within 15 cm, LED2 should light up with a  green color.  ➢ Set LED number 2 with a 300 ms delay when turning it on and a  400 ms delay when turning it off.  c) If the object is detected within 20 cm, LED3 should light up with a  blue color  ➢ Set LED number 3 with a 400 ms delay when turning it on and a  500 ms delay when turning it off.  5. Create database named”Motion\_db”  • Create table named “Motion\_data”to store motion data with the  following attributes: Id, Motion\_Detected and timestampESECOM RUCANODownloaded by HATEGEKIMANA DENIS CHRISTOPHE on Fri, 23 May 2025 07:44:49 CAT  TSS National Integrated Assessment 2024-2025 Page 3 of 12  6. Set up communication between the Arduino and a database to store  data recorded  7. Develop a PHP-based web interface to view the event details from the  database.  8. Verify the end-to-end functionality from object detection to view data  on the web interface. | 27 | 10 | 37.03 |
| **Networking and internet technologies (NIT)** | 1. Identify all the necessary Tools, materials and components for installing this IoT System.  2. Design a wiring diagram for this scenario by using PROTEUS SOFTWARE.  3. Mount all necessary components on Breadboard.  4. Write an Arduino program to detect objects with using the logic below:  a) If the object is detected within 30 cm, LED1 should light up with a red color.   Set LED number 1 with a 200 ms delay when turning it on and a 150 ms delay when turning it off.  b) If the object is detected within 20 cm, LED2 should light up with a green color.   Set LED number 2 with a 250 ms delay when turning it on and a 350 ms delay when turning it off.  c) If the object is detected within 10 cm, LED3 should light up with a blue color   Set LED number 3 with a 300 ms delay when turning it on and a 450 ms delay when turning it off.  5. Create database named”Motion\_db”   Create table named “Motion\_data”to store motion data with the following attributes: Id, Motion\_Detected and timestamp  6. Set up communication between the Arduino and a database to store data recorded  7. Develop a PHP-based web interface to view the event details from the database.  8. Verify the end-to-end functionality from object detection to view data on the web interface. | 17 | 10 | 58.82 |
| **Networking and internet technologies (NIT)** | Activities:  1. Identify all the necessary Tools, materials and components for installing this IoT System.  2. Design a wiring diagram for this scenario by using PROTEUS SOFTWARE.  3. Mount all necessary components on Breadboard.  4. Write an Arduino program to detect objects with using the logic below:  a) If the object is detected within 10 cm, LED1 should light up with a red color.   Set LED number 1 with a 350 ms delay when turning it on and a 250 ms delay when turning it off.  b) If the object is detected within 20 cm, LED2 should light up with a green color.   Set LED number 2 with a 400 ms delay when turning it on and a 200 ms delay when turning it off.ESECOM RUCANODownloaded by HATEGEKIMANA DENIS CHRISTOPHE on Tue, 27 May 2025 08:17:38 CAT  Page 3 of 5  c) If the object is detected within 30 cm, LED3 should light up with a blue color   Set LED number 3 with a 450 ms delay when turning it on and a 350 ms delay when turning it off.  5. Create database named”Motion\_db”   Create table named “Motion\_data”to store motion data with the following attributes: Id, Motion\_Detected and  timestamp  6. Set up communication between the Arduino and a database to store data recorded  7. Develop a PHP-based web interface to view the event details from the database.  8. Verify the end-to-end functionality from object detection to view data on the web interface | 7 | 7 | 100 |

1. **Trainees who missed in the examinations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Option code** | **Full index number of the candidates** | **Names of the candidate** | **Reason of the absence** | **Telephone number if any** |
|  |  |  |  |  |

1. **Private Candidates missed in the examinations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Option code** | **Full index number of the candidates** | **Names of the candidate** | **Reason of the absence** | **Telephone number if any** |
|  |  |  |  |  |

1. **Candidates who sat for exams out of the allocated examinations center**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Option code | Index number of the candidates | Names of the candidates | First Examination center | New location of examination | Explanations | Date of examinations |
|  |  |  |  |  |  |  |

1. **Other technical observations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date and period** | **Description of the Observed case** | **Resolutions taken** | **Result** |
|  |  |  |  |

1. **Participants to the integrated assessment activities at the examinations center**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/No** | **Names of the Participants** | **National ID Card number** | **Telephone number** | **Origin** | **Responsibilities to the Integrated assessment** | **Signature** |
| **1** | **NIYOMWUNGERI Aphrodis** | **1199880048651263** | **0786738906** | **Ipk kirinda TSS** | **PA** |  |
| **2** | **HITAYEZU Jean pierre** | **1199780161764078** | **0789648363** | **ITB Ruhengeri TSS** | **PA** |  |
| **3** | **UWAYISABA Edissa** | **1200270088345045** | **0789471676** | **APARPE TSS** | **PA** |  |
| **4** | **SHIKAMUSENGE Philemon** | **1200080137900043** | **0787716701** | **HOPE TSS** | **PA** |  |
| **5** | **NTAKIRUTIMANA Sabin** | **1200280136706087** | **0787936051** | **HOPE TSS** | **PA** |  |
| **6** | **LEOPOLD Dusingizimana** | **1198680109346003** | **0788660920** | **RTC TSS** | **PA** |  |
| **7** | **MANITEZE Olivier** | **1198880211685260** | **0738346526** | **Ipk kirinda TSS** | **TAC** |  |

**Conclusion**

**Recommendations**

Done at ESECOM RUCANO on 28/05/ 2025

Head of Examination center (names and Signature) D/Head of Examination center (Dos) – Names and Signature

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**School Stamp**

**Attach the Non-Disclosure Agreement and bind them with the report.**