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COURSE CODE: 315004

TOPIC: INDUSTRIAL TRAINING REPORT ON
"ARTIFICIAL INTELLIGENCE USING PYTHON"

SUBMITTED BY :

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Maharashtra State Board of Technical Education

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Abstract

This report summarizes my 12-week industrial training at **Mass IT Solutions Pvt. Ltd., Pune**, undertaken as part of the Diploma in Computer Technology at **Bharati Vidyapeeth's JNIOT, Pune**.

The objective of the internship was to gain practical exposure to **Artificial Intelligence, Machine Learning, and Deep Learning using Python**. During this period, I worked on a project titled **"Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods."** The project involved **data preprocessing, CNN model training, performance evaluation, and deployment** using tools such as **NumPy, Pandas, TensorFlow, Keras, and Scikit-learn**.

The internship enhanced my understanding of **data analysis, neural networks, and predictive modeling**, along with hands-on experience in **Python programming and web deployment frameworks** like **Flask** and **Streamlit**.

Overall, the training provided valuable industrial exposure and strengthened my technical, analytical, and problem-solving skills.

Acknowledgement

I would like to express my sincere gratitude to **Mass IT Solutions Pvt. Ltd., Pune**, for providing me the opportunity to undergo industrial training and gain valuable practical experience in the field of **Artificial Intelligence and Machine Learning**.

I am deeply thankful to my **industry mentor, Mr. Milind Ankleshwar**, for his continuous guidance, support, and technical insights throughout the internship. His mentorship helped me understand real-world project development and industrial practices.

I am also thankful to my **faculty mentor, Prof. V. A. Upadhaye**, for his constant encouragement, valuable suggestions, and motivation during the training period.

My heartfelt thanks to the **Principal, Head of Department, and all faculty members** of the **Computer Technology Department, Bharati Vidyapeeth's JNIOT, Pune**, for providing this learning opportunity and for their continuous support.

Lastly, I wish to thank my **family and friends** for their constant encouragement and inspiration throughout this training journey.

Chapter 1 – Organization Structure of Industry and General Layout

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Mass IT Solutions Pvt. Ltd., Pune is a recognized software development and technical training organization specializing in **Artificial Intelligence, Machine Learning, Data Science, and Python Programming**. The company focuses on bridging the gap between academic learning and industrial requirements by providing real-time project experience to students and trainees.

The organization is structured to ensure effective coordination and smooth workflow among various departments such as **Training**, **Research and Development**, **Project Implementation**, and **Technical Support**. Each department functions with a specific goal to support both client projects and student training activities.

The company follows a **hierarchical structure** consisting of a **Managing Director**, **Project Managers**, **Team Leaders**, **Developers**, and **Interns**. The Managing Director oversees overall operations, Project Managers handle project allocation and monitoring, Team Leaders guide development work, while Interns assist in data handling, coding, and documentation.

During my internship, I was placed under the **AI and Machine Learning division**, where I worked on the project titled "Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods." My responsibilities included data preprocessing, CNN model development, model evaluation, and basic deployment using frameworks such as **Flask** and **Streamlit**.

Interns were required to bring and use their own laptops for all project activities.The organization provides a modern and collaborative workspace equipped with reliable internet connectivity, and essential software tools including **Python, Jupyter Notebook, TensorFlow, Keras, Pandas, and GitHub** for version control. The work culture emphasizes teamwork, discipline, and continuous technical improvement.

This professional environment helped me understand how industrial projects are managed, coordinated, and executed systematically. It also gave me exposure to real-world applications of AI and provided valuable experience in professional communication and teamwork.

Chapter 2 – Introduction to Industry / Organization

Mass IT Solutions Pvt. Ltd., Pune is a reputed IT training and software development company that focuses on providing **industry-oriented education and project experience** in emerging technologies such as **Python, Artificial Intelligence (AI), Machine Learning (ML), Data Science, Web Development, and Full Stack Development**. The company's vision is to create skilled professionals who can apply modern technologies to solve real-world industrial problems.

The organization emphasizes **learning through practical implementation**. Trainees and interns work on **live projects and real-time datasets**, gaining valuable experience in data analysis, model development, and system integration. This approach helps bridge the gap between classroom concepts and industrial applications.

Apart from training programs, Mass IT Solutions also undertakes **software development and research projects** for clients. These include automation systems, AI-based analytical tools, and web applications designed to enhance business productivity and decision-making.

The company is managed by experienced professionals and industry mentors who guide students through each stage of project development. Their mentorship ensures that trainees not only learn programming and technical concepts but also understand **team collaboration, documentation, and version control practices** used in real organizations.

Through its structured programs, supportive environment, and focus on innovation, **Mass IT Solutions Pvt. Ltd.** provides a platform for students to develop strong technical foundations and prepare themselves for future careers in the IT and AI industry.

Chapter 3 – Types of Major Equipment / Software Used

During the internship at **Mass IT Solutions Pvt. Ltd., Pune**, all practical work and project activities were performed using laptops brought by the trainees. The company provided necessary software tools, cloud access, and guidance for working on Artificial Intelligence and Machine Learning projects. The project titled "Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods" required various software, libraries, and platforms as listed below.

3.1 Hardware Used

- **Laptop (Personal System):** Used for coding, training models, and testing applications.
- **Internet Connection:** For accessing datasets, documentation, and cloud repositories.
- **External Storage Devices (if required):** Used for saving trained models and reports.

3.2 Software and Tools Used

1. **Python 3.12** – Primary programming language used for data processing, training models, and implementing algorithms.
2. **Jupyter Notebook / VS Code** – Platforms used for writing, testing, and debugging Python code.
3. **NumPy and Pandas** – Libraries for numerical operations, data preprocessing, and dataset handling.
4. **Matplotlib and Seaborn** – Used for graphical representation, data visualization, and performance plots.
5. **Scikit-learn** – Implemented traditional ML algorithms such as KNN, SVM, Logistic Regression, and XGBoost.
6. **TensorFlow and Keras** – Used to design, train, and evaluate the Convolutional Neural Network (CNN) model for ECG image classification.
7. **Streamlit, Flask, and Django** – Frameworks used for developing simple web-based interfaces for ECG image upload and prediction.
8. **GitHub** – Used for version control, maintaining code repositories, and sharing project files with mentors.
9. **MS Excel / Google Sheets** – Utilized for maintaining records of datasets, model accuracy, and results comparison.

3.3 Cloud and Supporting Platforms

- **Google Drive / Google Colab:** Used for cloud storage, data access, and training deep learning models online.
- **TensorBoard:** Used for visualizing CNN model training progress and performance metrics.

Chapter 4 – Processes / Methodologies and Material Handling Procedures

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During the internship at **Mass IT Solutions Pvt. Ltd., Pune**, a systematic approach was followed to complete the project "Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods." The process involved multiple stages, from data collection to model deployment. Each step was carried out under the guidance of industry mentors, ensuring proper technical understanding and workflow discipline.

4.1 Process Overview

The internship followed a structured methodology consisting of the following stages:

1. **Problem Understanding and Research** – Studying ECG signal concepts and identifying the project objective.
2. **Data Collection and Preprocessing** – Gathering ECG image datasets and preparing them for training.
3. **Model Design and Training** – Implementing CNN and ML algorithms using Python libraries.
4. **Model Evaluation and Optimization** – Testing performance and improving accuracy through tuning.
5. **Interface Development** – Creating user interfaces for ECG image upload and prediction using Flask and Streamlit.
6. **Documentation and Report Preparation** – Recording results, graphs, and findings for final submission.

4.2 Methodology Used

The **project followed a machine learning workflow** that included:

- Importing datasets and converting them into NumPy arrays for model compatibility.
- Performing data cleaning, resizing, and normalization to improve consistency.
- Designing and training the **Convolutional Neural Network (CNN)** model for ECG image classification.
- Extracting and analyzing features using ML models such as **SVM**, **KNN**, and **XGBoost** for comparison.
- Saving trained models using **Joblib** and integrating them into user-friendly web apps.

4.3 Material and Data Handling

Since the project was digital in nature, **data files and trained models were treated as project materials**. All datasets, scripts, and results were:

- Stored securely in personal laptops and Google Drive.
- Properly labeled with file names like train_data.npz, cnn_model.h5, etc.
- Backed up regularly to prevent data loss.
- Version-controlled using **GitHub** for tracking code updates.

4.4 Workflow and Collaboration

Daily progress was discussed with mentors during review sessions. Errors, model improvements, and dataset refinements were recorded systematically. Team discussions encouraged problem-solving and optimization techniques, helping ensure the accuracy and efficiency of the project.

Chapter 5 – Testing of Hardware / Software / Raw Materials / Products and Handling Procedures

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Testing played a crucial role during the development of the project "Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods." Since the project involved software-based systems, all testing procedures were focused on ensuring the **accuracy, reliability, and performance** of the machine learning and deep learning models.

5.1 Objective of Testing

The objective of testing was to:

- Verify the correctness of each code module.
- Evaluate the performance of trained models.
- Ensure smooth functioning of the prediction interface.
- Minimize errors and improve system accuracy before final deployment.

5.2 Types of Testing Performed

1. **Unit Testing:**
   Each Python script and function was tested individually to ensure correct execution. Data preprocessing, model loading, and prediction modules were verified separately before integration.
2. **Model Evaluation:**
   The CNN and traditional ML models were tested using performance metrics such as **Accuracy**, **Precision**, **Recall**, and **F1 Score**.
   - Confusion matrices and classification reports were generated for each model.
   - CNN performance was analyzed using validation accuracy and loss graphs.
1. **Integration Testing:**
   After model training, all components (data input, model, and output interface) were integrated. The combined system was tested to verify end-to-end functionality from image upload to prediction output.
2. **Interface Testing:**
   The web apps created using **Flask** and **Streamlit** were tested for input validation, model response time, and correct display of prediction results.
3. **Performance and Optimization Testing:**
   Hyperparameters such as learning rate, batch size, and optimizer type were tuned to achieve better accuracy and stability during model training.

5.3 Tools Used for Testing

- **Python 3.12** – For executing and debugging code.

- **TensorFlow & Keras** – For CNN model evaluation.
- **Scikit-learn** – For generating accuracy reports and confusion matrices.
- **Streamlit / Flask** – For interface testing and deployment verification.

5.4 Data Handling and Verification

All datasets used for testing were properly labeled and divided into **training**, **validation**, and **testing sets**. Each model was verified using unseen test data to ensure unbiased results. Data backups were maintained on **Google Drive** and **GitHub** to prevent loss and maintain version history.

Chapter 6 – Safety Procedures Followed and Safety Gears Used by Industry

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At **Mass IT Solutions Pvt. Ltd., Pune**, safety and discipline were given high importance throughout the internship period. Since the work environment involved **software development and data analysis**, the safety procedures mainly focused on **data security, system reliability, and maintaining a safe and organized workspace**.

6.1 Data and System Safety

All trainees were instructed to follow proper data handling and cybersecurity practices. Sensitive datasets, project codes, and trained models were stored securely in cloud repositories and personal laptops. Access to files was restricted, and version control systems like **GitHub** were used to avoid accidental data loss. Strong passwords and antivirus protection were maintained on every system.

6.2 Workstation Safety

Interns were responsible for using their **own laptops** for project execution. Regular system updates, safe coding practices, and controlled environment testing were followed to prevent hardware or software failures. Proper cable management and clean desk practices were encouraged to maintain an organized and safe workspace.

6.3 Data Backup and Recovery

To prevent data loss during model training or testing, all important project files and results were **regularly backed up** on **Google Drive and GitHub**. Each version of the code and model was properly labeled, ensuring easy recovery in case of any system crash or error.

6.4 Cybersecurity and Ethical Practices

Interns were instructed not to share project data, client information, or internal files outside the organization. Ethical coding, secure data usage, and compliance with software licensing policies were strictly maintained throughout the internship.

6.5 Personal and Environmental Safety

Although physical machinery was not involved, general workplace discipline and safety were ensured. Interns followed time management, attended review sessions, and maintained a professional and respectful environment while working in teams.

Chapter 7 – Particulars of Practical Experiences in Industry / Organization

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During my internship at **Mass IT Solutions Pvt. Ltd., Pune**, I gained valuable hands-on experience in **Artificial Intelligence, Machine Learning, and Deep Learning**. The training involved understanding real-world data workflows and implementing technical concepts learned during the diploma course in a professional setup.

7.1 Practical Work Overview

The main focus of the internship was the development of the project titled “Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods.” My practical tasks included **data collection, preprocessing, CNN model training, and evaluation** using Python-based tools. The work helped me apply academic concepts to practical problem-solving in the healthcare AI domain.

7.2 Tools and Platforms Used

All project activities were carried out on my **personal laptop** using various tools such as:

- **Python 3.12** for programming and model implementation
- **Jupyter Notebook / VS Code** for coding and visualization
- **TensorFlow and Keras** for CNN model development
- **Scikit-learn** for traditional ML algorithms
- **Flask and Streamlit** for creating web-based prediction interfaces
- **GitHub** for version control and file sharing

7.3 Key Activities Performed

- Collected and organized ECG image datasets for model training
- Applied preprocessing techniques like resizing, normalization, and labeling

- Trained multiple models (CNN, KNN, SVM, Logistic Regression, XGBoost)
- Compared results to identify top-performing models
- Designed simple web apps for ECG image upload and prediction display
- Documented results, confusion matrices, and accuracy reports

7.4 Learning and Skill Development

Through these activities, I learned:

- How AI and ML models are developed and evaluated
- The importance of data preprocessing and model optimization
- Basic principles of web integration and deployment
- Practical teamwork, time management, and project documentation skills

Chapter 8 – Detailed Report of the Tasks Undertaken (During the Training)

During my 12-week internship at **Mass IT Solutions Pvt. Ltd., Pune**, I worked on the complete development process of the project "Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods." The training was divided into multiple phases covering Python fundamentals, data preprocessing, model development, testing, and deployment.

8.1 Week 1 – Orientation and Python Setup

- Introduction to company, work environment, and internship objectives.
- Installation and setup of Python, VS Code, and required libraries.
- Practiced basic programs covering data types, operators, loops, and conditional statements.

8.2 Week 2 – Advanced Python and Data Structures

- Implemented lists, tuples, sets, and dictionaries.
- Wrote programs involving file handling and exception handling.
- Practiced modular programming and logic building.

8.3 Week 3 – Introduction to Data Science

- Learned basics of **NumPy** and **Pandas** for data analysis.
- Worked on importing, cleaning, and organizing datasets.
- Studied visualization libraries like **Matplotlib** and **Seaborn**.

8.4 Week 4 – Data Preprocessing

- Explored real ECG datasets from online sources.
- Performed cleaning, normalization, and labeling of ECG image data.
- Split the dataset into training and testing sets for model training.

8.5 Week 5 – CNN Model Development

- Designed the **Convolutional Neural Network (CNN)** model architecture.
- Trained the model on ECG images using **TensorFlow** and **Keras**.
- Observed accuracy, validation loss, and improved model parameters.

8.6 Week 6 – Machine Learning Models

- Applied ML algorithms such as **KNN**, **SVM**, **Logistic Regression**, and **XGBoost** on extracted features.
- Compared their performance with CNN results.
- Selected top-performing models for final evaluation.

8.7 Week 7 – Model Evaluation and Testing

- Evaluated models using metrics such as **accuracy**, **precision**, **recall**, and **F1-score**.
- Generated confusion matrices and classification reports.
- Saved trained models for future prediction.

8.8 Week 8 – Prediction Function and Interface

- Developed Python functions for ECG image input and result prediction.
- Built basic user interfaces using **Flask** and **Streamlit**.
- Displayed class labels and accuracy scores through web dashboards.

8.9 Week 9 – Deployment and Testing

- Tested models with new ECG images for prediction accuracy.
- Debugged interface issues and ensured smooth input-output workflow.
- Integrated prediction modules into the final application.

8.10 Week 10–12 – Documentation and Report Preparation

- Compiled project results, performance graphs, and confusion matrices.
- Prepared final documentation and presentation slides.
- Conducted final review meetings and submitted the project successfully.

Chapter 9 – Special / Challenging Experiences Encountered During Training

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During my internship at **Mass IT Solutions Pvt. Ltd., Pune**, I faced several challenges while working on the project "Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods." These challenges helped me develop stronger technical problem-solving skills and improved my ability to handle real-world project issues effectively.

9.1 Data Collection and Preprocessinga

The first major challenge was collecting and preparing a proper dataset. The ECG image datasets downloaded from online sources contained **noise, irregular image sizes, and unclear labels**. I had to perform resizing, normalization, and filtering to make the data suitable for model training. This process required patience and a good understanding of data preprocessing techniques.

9.2 Model Accuracy and Optimization

Initially, the **CNN model produced low accuracy** due to improper parameter tuning. Understanding the role of learning rate, epochs, and batch size took several iterations. By applying **hyperparameter tuning** and using optimization functions, I was able to significantly improve the model's accuracy and stability.

9.3 Integration and Interface Issues

While connecting the trained models to web interfaces using **Flask** and **Streamlit**, several **compatibility and path errors** occurred. Debugging these issues required careful code analysis and repeated testing to ensure that the model loaded correctly and displayed accurate predictions on the interface.

9.4 Version Control and File Management

Handling multiple model versions, datasets, and output files was also challenging. Initially, files got mixed up between different versions. Later, using **GitHub** for version control and maintaining proper folder organization helped manage the project efficiently.

Chapter 10 – Conclusion

The 12-week internship at **Mass IT Solutions Pvt. Ltd., Pune** provided an excellent opportunity to gain **practical exposure to Artificial Intelligence, Machine Learning, and Deep Learning applications**. Working on the project "**Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods**" allowed me to apply theoretical knowledge to real-world data and develop a complete AI-based solution.

Throughout the internship, I learned various technical concepts such as **data preprocessing, CNN model design, evaluation metrics, and web-based deployment** using Python frameworks. It also helped me understand the **workflow of industrial projects**, including teamwork, documentation, and time management.

This experience enhanced my **technical, analytical, and problem-solving abilities**, and gave me a better understanding of how AI technologies can be applied in the healthcare field. The internship served as a strong foundation for my future academic and professional growth in the area of Artificial Intelligence and Data Science.

Chapter 11 – References / Sources of Information

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