Transforming Traditional Education with PHP: Building an Online Classroom

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Abstract- **The advent of online education has revolutionized traditional classroom settings, offering flexibility and accessibility to a wide range of learners. In line with this trend, this project proposes the development of an Online Classroom ManagementSystem using PHP. The system aims to provide a comprehensive platform for educators and students toengage in virtual learning environments. Key features of the system include user authentication, class management, assignment submission, discussion forums, and grading functionalities.**

Users will be able to register, log in, and access their respective classes. Teachers cancreate and manage classes, post announcements, assign tasks, and evaluate student submissions. Students can enroll in classes, participate in discussions, submit assignments, and track their progress.

The system will be developed using PHP programming language, HTML, CSS, and JavaScript for frontend development, and MySQL for database management.

Security measures will be implemented to ensure data confidentiality and integrity,including password hashing, input validation, and protection against common web vulnerabilities.

Keywords— Online classroom, Php, Traditional Education, Php code

I. INTRODUCTION

In an era where digital transformation is revolutionizing every aspect of our lives, education is no exception. Traditional classroom settings are increasingly being complemented, and in some cases, replaced by online learning environments that offer flexibility, accessibility, and a wealth of resources at the fingertips of students and educators alike. Central to this shift is the use of powerful web development tools and languages, with PHP emerging as a key player in the creation of dynamic and interactive online classrooms.

PHP, a popular server-side scripting language, is renowned for its versatility and ease of use. It empowers developers to build robust, scalable, and feature-rich online learning platforms that cater to the diverse needs of modern education. From managing student enrollments and assignments to facilitating real-time communication and collaboration, PHP-based online classrooms provide a comprehensive solution for delivering high-quality education in a virtual setting.

In this article, we will explore how PHP can be leveraged to transform traditional education by building an effective and engaging online classroom. We will delve into the essential features of a PHP-powered e-learning platform, examine the benefits it offers to educators and students, and provide a step-by-step guide to creating your own online classroom using PHP. Whether you are an educator looking to expand your teaching methods, a developer seeking to enter the education technology space, or simply curious about the intersection of technology and learning, this guide will equip you with the knowledge and tools to harness the power of PHP in education.

II. PURPOSE AND OBJECTIVE

The purpose of the "Online Classroom using PHP" project is to create a robustand user-friendly platform that facilitates virtual learning experiences for students and educators. The primary objective is to develop a comprehensive online classroom management system that addresses the following goals:

1. **Accessibility**: Provide a platform that enables students to access coursematerials, lectures, and assignments from anywhere with an internet connection, promoting inclusivity and flexibility in education.
2. **Engagement**: Foster active participation and engagement among studentsthrough interactive features such as discussion forums, live chat, and collaborative tools, enhancing the learning experience and promoting knowledge sharing.
3. **Efficiency**: Streamline administrative tasks for educators by automating processes such as class creation, assignment distribution, grading, and feedback delivery, saving time and resources while ensuring effective management of course materials and student progress.
4. **Accountability**: Implement mechanisms for tracking student attendance, assignment submissions, and performance metrics, enabling educators to monitor student engagement and intervene when necessary to support studentsuccess.
5. **Collaboration**: Facilitate collaboration and communication between studentsand educators, as well as peer-to-peer interaction, to encourage teamwork, problem-solving, and the exchange of ideas within a virtual classroom environment.

III. TOOLS AND TECHNOLOGIESW

PHP and MySQL database:

PHP is a server-side scripting language primarily used for web development but also used as a general-purpose programming language. It is embedded within HTML code and interpreted by the web server to generate dynamic web pages.

- Open-source: PHP is freely available and supported by a large community of developers.
- Cross-platform compatibility: PHP applications can run on various operating systems, including Windows, Linux, macOS, etc.

- Database connectivity: PHP provides built-in functions and extensions for interacting with databases like MySQL, PostgreSQL, SQLite, etc.
- Scalability: PHP is scalable and suitable for developing small websites to large-scale enterprise applications.
- MySQL is an open-source relational database management system (RDBMS) that uses SQL (Structured Query Language) for managing and manipulating data. It is one of the most popular databases for web applications.
- Reliability and performance: MySQL is known for its reliability, scalability, and high performance, making it suitable for handling large volumes of data and high-traffic websites.
- ACID compliance: MySQL supports ACID (Atomicity, Consistency, Isolation, Durability) properties to ensure data integrity and transactional consistency.
- Replication and clustering: MySQL supports replication and clustering features for high availability and fault tolerance.

HTML

HTML stands for HyperText Markup Language. It is the standard markup language used to create web pages. HTML is a combination of Hypertext and Markup language. Hypertext defines the link between web pages. A markup language is used to define the text document within the tag to define the structure of web pages.

This language is used to annotate (make notes for the computer) text so that a machine can understand it and manipulate text accordingly. Most markup languages (e.g. HTML) are human-readable. The language uses tags to define what manipulation has to be done on the text.

- It is easy to learn and easy to use.
- It is platform-independent.
- Images, videos, and audio can be added to a web page.
- Hypertext can be added to the text.
- It is a markup language.

CSS

CSS (Cascading Style Sheets) is a simply designed language intended to simplify the process of making web pages presentable. CSS allows you to apply styles to HTML documents. It describes how a webpage should look. It prescribes colors, fonts, spacing, etc. In short, you can make your website look however you want. CSS lets developers and designers define how it behaves, including how elements are positioned in the browser.

HTML uses tags and CSS uses rulesets. CSS styles are applied to the HTML element using selectors. CSS is easy to learn and understand, but it provides powerful control over the presentation of an HTML document

Bootstrap

Bootstrap is a widely-used open-source front-end framework for web development, providing a collection of HTML, CSS, and JavaScript components and tools that enable developers to build responsive, mobile- first websites with ease. By using this framework we can easily manipulate the styling of any web page, like font style, text color, background color, flex, grid system, etc. Bootstrap Vesrion 4 & Vesrion 5 are the most popular versions. There are lots of other CSS frameworks like Tailwind CSS, Bulma, and Foundation but among them, this framework is the most popular because of below mentioned features:

- It is Faster and Easier way for Web-Development.
- It creates Platform-independent web-pages.
- It creates Responsive Web-pages.

JavaScript:

•JavaScript is the most popular scripting language for the Web. It is easy to learn, lightweight, cross-platform, single-threaded, and interpreted compiled language.

•It is widely used for web development, both on the client side and server side. As a scripting language, it plays an important role in web browsers, allowing real-time modification of web page content and enhancing user experience.

•In this JavaScript Tutorial, we'll learn all the basics to advanced topics and concepts of JavaScript. This tutorial will introduce you to JavaScript from basic to advanced. Here we learn JavaScript from scratch to advanced concepts like OOP, Closures, Event loops

IV. CODE DEVELOPMENT

index.php

```
<?php include('allhead.php'); ?>
<!-- Header Carousel -->
<header id="myCarousel" class="carousel slide">
<!-- Indicators -->
<ol class="carousel-indicators">
<li data-target="#myCarousel" data-slide-to="0" class="active"></li>
<li data-target="#myCarousel" data-slide-to="1"></li>
<li data-target="#myCarousel" data-slide-to="2"></li>
</ol>
<!-- Wrapper for slides -->
<div class="carousel-inner">
<div class="item">
<div class="fill" style="background-image:url('images/1707.jpg');"></div>
<div class="carousel-caption">
<h2 ><mark> Making Learning Easy</mark></h2>
</div>
</div>
<div class="item active">
<div class="fill" style="background-image:url('images/1900x10800.jpg');"></div>
<div class="carousel-caption">
<a href="registrationform"><h2 style="color: white;"><mark>Register Now</mark></h2></a>
</div>
</div>
<div class="item">
<div class="fill" style="background-image:url('images/198989.jpg');"></div>
<div class="carousel-caption">
<a href="takeassessment"><h2 style="color: white; "><mark>Take Assessment</mark></h2>
```



```
</div>
</div>
</div>
<!-- Controls -->
<a class="left carousel-control" href="#myCarousel" data-slide="prev">
<span class="icon-prev"></span>
</a>
<a class="right carousel-control" href="#myCarousel" data-slide="next">
<span class="icon-next"></span>
</a>
</header>
<!-- Page Content -->
<div class="container" style="max-width: 1200px;">
<!-- Marketing Icons Section -->
<div class="row">
<div class="col-lg-12 text-center">
<h1 class="page-header"> Welcome to Online Classroom
</h1>
Us</h4>
</div>
<div class="col-md-4">
<div class="panel panel-default">
<div class="panel-heading">
<h4><i class="fa fa-fw fa-check"></i> About
</div>
<div class="panel-body">
<ul style="list-style-type:disc">
<li>
(web based application) is useful for the to learn from web using E-Learn
schedules of assessment and all that task like of fresh courses offered by them and
fee structure etc. without going to students or guest to have complete
</li>
</ul>
</p>
<p>The “Online Classroom” Website students, faculty, guest whomever likes (Videos), as well Check result,
event, news, students can find out list admission procedure, discussion forum, institute. It provides the facility to the information about the institute.
</div>
</div>
</div>
<a href="#" class="btn btn-default">Learn More</a>
<div class="col-md-4">
<div class="panel panel-default">
<div class="panel-heading">
<h4><i class="fa fa-fw fa-gift"></i> Objectives</h4>
</div>
<div class="panel-body">
<p>
Admin & Guest.</li> institute.</li>
learn). Institute.
conflict.<br></li>
<ul style="list-style-type:disc">
<li>Keep records of all Students, Faculty,
<li>To make the institute truly a paperless
<li>To learn from by watching videos (e-
</li>
<li>To make the institute truly a Cloud Based
</li>
<li>For reducing manual work and mental
</ul>
</p>
</div>
</div>
</div>
<a href="#" class="btn btn-default">Learn More</a>
<div class="col-md-4">
<div class="panel panel-default">
<div class="panel-heading">
<h4><i class="fa fa-fw fa-compass"></i> Project Category & Technology Used</h4>
System)</li>
</div>
<div class="panel-body">
<p>
<ul style="list-style-type:disc">
<li>RDBMS (Relational Database Management
<li>BOOTSTRAP</li>
<li>APACHE SERVER</li>
<li>PHP</li>
<li>MYSQL</li>
</ul>
</p>
<a href="#" class="btn btn-default">Learn More</a>
</div>
</div>
</div>
</div>
<!-- /.row -->
<!-- /.row -->
<hr>
<?php include('allfoot.php'); ?>

Studentlogin.php
<?php include('allhead.php'); ?>
<div class="container">
<div class="row">
<div class="col-md-4"></div>
<div class="col-md-4">
<!-- Stdeunt login page -->
<fieldset>
<legend>
<h3 style="padding-top: 25px;"><span class="glyphicon glyphicon-lock"></span>  Student Login</h3>
</legend>
<form name="studentlogin" action="loginlinkstudent" method="POST">
control" name="sid" required>
<div class="control-group form-group">
<div class="controls">
<label>Email:</label>
<input type="text" class="form-
<p class="help-block"></p>
</div>
```

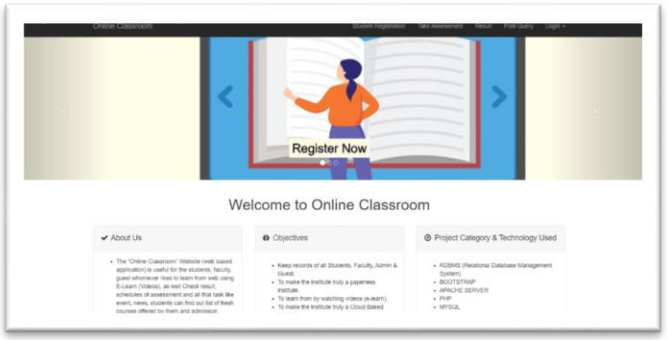


```
</div>
control" name="pass" required>
<div class="control-group form-group">
<div class="controls">
<label>Passsword:</label>
<input type="password" class="form-
<p class="help-block"></p>
</div>
</div>
<center>
<button type="submit" name="login" class="btn btn-success"
style="border-radius:0%">Login</button>
<button type="reset" class="btn btn-danger"
style="border-radius:0%;">Reset</button>
</fieldset>
</form>
</center>
</div>
<div class="col-md-4"></div>
</div>
<?php include('allfoot.php'); ?>
<?php include('allhead.php'); ?>
</nav>
<div class="container">
<div class="row">
<div class="col-md-4"></div>
<div class="col-md-4">
<fieldset>
<!-- Faculty login page -->
<legend>
<h3 style="padding-top: 25px;"><span class="glyphicon
glyphicon-lock"></span>  Faculty Login</h3>
</legend>
<form name="facultylogin" action="loginlinkfaculty"
method="POST">
<div class="control-group form-group">
<div class="controls">
<label>Faculty ID:</label>
<input type="text" class="form-control"

name="fid" required data-validation-required-
message="Please enter your Faculty Id.">
<p class="help-block"></p>
</div>
</div>
<div class="control-group form-group">
<div class="controls">
<label>Passsword:</label>
<input type="password" class="form-control" name="pass"
required data-validation-required-message="Please enter
your password.">
<p class="help-block"></p>
</div> </div>
<center>
<button type="submit" class="btn btn-success"
style="border-radius:0%">Login</button>
<button type="reset" class="btn btn-danger"
style="border-radius:0px;" >Reset</button>
</center>
</fieldset>
</form>
</div>
<div class="col-md-4"></div>
</div>
<?php include('allfoot.php'); ?>
Admin login:
<?php include('allhead.php'); ?>
<div class="container">
<div class="row">
</div>
<div class="row">
<div class="col-md-4"></div>
<div class="col-md-4">
<fieldset>
<legend>
<h3 style="padding-top: 25px;"><span class="glyphicon
glyphicon-lock"></span> Admin Login</h3>
</legend>
<!-- Admin login form -->
<form name="adminlogin" action="loginlinkadmin.php"
method="POST">
<div class="control-group form-group">
name="aid">
control" name="apass">
<div class="controls">
<label>Username:</label>
<input type="text" class="form-control"
<p class="help-block"></p>
</div>
</div>
<div class="control-group form-group">
<div class="controls">
<label>Passsword:</label>
<input type="password" class="form-
<p class="help-block"></p>
</div>
</div>
<center>
<button type="submit" name="login"
class="btn btn-success" style="border-
radius:0%">Login</button>
<button type="reset" class="btn btn-danger" style="border-
radius:0%">Reset</button>
</center>
</fieldset>
</form>
</div>
<div class="col-md-4"></div>
</div>
<?php include('allfoot.php'); ?>
```

V. SCREENSHOTS

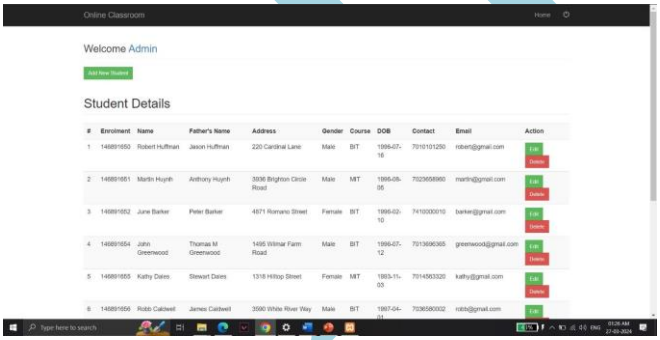
MAIN PAGE

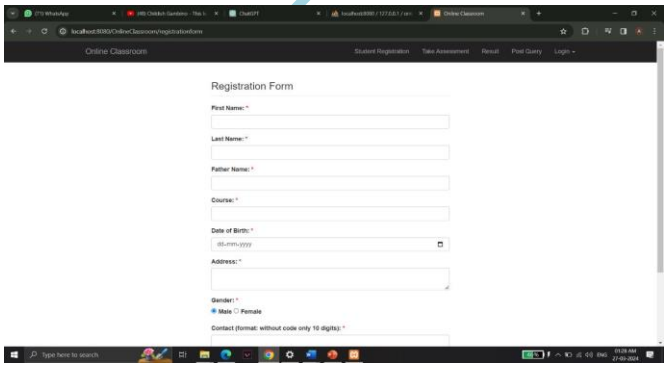


ADMIN DASHBOARD

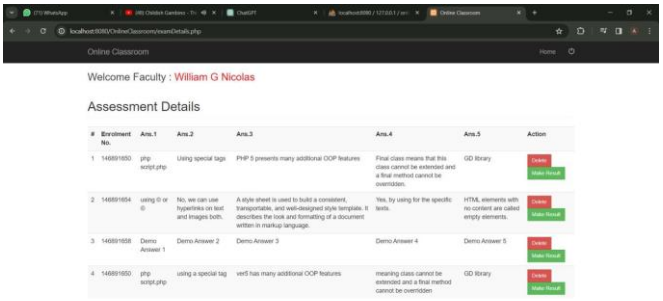
ADMIN LOGIN

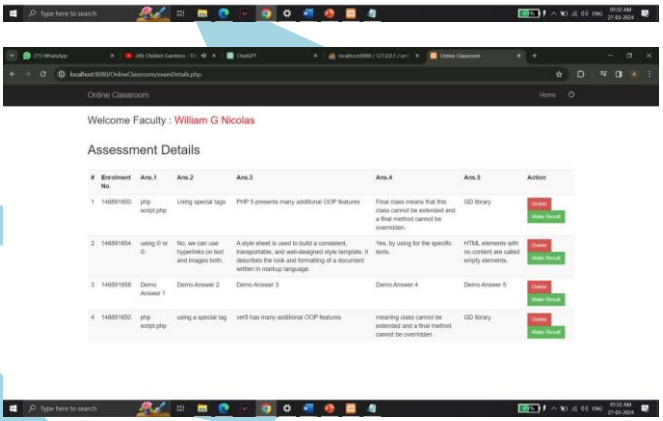
ADDING STUDENT





ASSESMENT DETAILS





CONCLUSION

In conclusion, the development of an online classroom using PHP represents a significant advancement in modern education, offering a dynamic and accessible platform for learning in virtual environments. Throughout this project, we have meticulously designed and implemented various features and functionalities to create an effective online learning ecosystem.

By harnessing the power of PHP along with other essential technologies such as MySQL, HTML/CSS/JavaScript, and possibly frameworks like Bootstrap, we have constructed a robust infrastructure capable of supporting diverse educational activities. From user authentication to class management, assignment submission, discussion forums, and grading systems, our online classroom solution is equippedwith comprehensive tools to facilitate effective teaching and learning experiences.

Moreover, the project underscores the importance of adaptability, interactivity, efficiency, and security in the design and implementation of online educational platforms. By prioritizing these aspects, we aim to provide educators and students with a seamless and engaging learning environment that transcends traditional boundaries.

As we conclude this project, it becomes evident that online classrooms powered by PHP have the potential to revolutionize education by fostering collaboration, expanding access to learning resources, and accommodating diverse learning styles. By embracing innovation and leveraging technology, we can shape the future of education and empower learners worldwide to

achieve their academic goals regardless of geographical constraints or physical limitations.

FUTURE ENHANCEMENT

1. Integration of Multimedia Content
2. Real-time Collaboration Tools
3. Adaptive Learning Algorithms
4. Mobile Compatibility
5. Gamification Elements
6. Advanced Analytics and Reporting
7. Accessibility Features
8. Social Learning Communities
9. Integration with Learning Management Systems (LMS)
10. Enhanced Security Measures

REFERENCES

[1]. Welling, L., Thomson, L. (2016). "PHP and MySQL Web Development" (5thEdition). Addison-Wesley.

[2]. Dalal, S., Lilhore, U. K., Sharma, N., Arora, S., Simaiya, S., Ayadi, M., ... & Ksibi, A. (2024). Improving smart home surveillance through YOLO model with transfer learning and quantization for enhanced accuracy and efficiency. PeerJ Computer Science, 10, e1939.

[3]. Rahman, H., Wahid, S. A., Ahmad, F., & Ali, N. (2024). Game-based learning in metaverse: Virtual chemistry classroom for chemical bonding for remote education. Education and Information Technologies, 1-25.

[4]. Aman Chhillar RS, Alhussein M, Dalal S, Aurangzeb K and Lilhore UK (2024) Enhanced cardiovascular disease prediction through self-improved Aquila optimized feature selection in quantum neural network & LSTM model. Front. Med. 11:1414637. doi: 10.3389/fmed.2024.1414637

[5]. Rani, U., Kumar, S., Dahiya, N., Solanki, K., Kuttan, S. R., Shah, S., ... & Ahmad, F. (2024). An optimized neural network with AdaHessian for cryptojacking attack prediction for Securing Crypto Exchange Operations of MEC applications. Journal of Cloud Computing, 13(1), 63.

[6]. Singh, G., & Ahmad, F. (2024). An interactive augmented reality framework to enhance the user experience and operational skills in electronics laboratories. Smart Learning Environments, 11(1), 5.

[7]. Dalal, S., Lilhore, U. K., Faujdar, N., Samiya, S., Jaglan, V., Alroobaea, R., ... & Ahmad, F. (2024). Optimising air quality prediction in smart cities with hybrid particle swarm optimization-long-short term memory-recurrent neural network model. IET Smart Cities. https://doi.org/10.1049/smc2.12080

[8]. Shaheen, M., Anjum, M. J., Ahmad, F., & Anum, A. (2023). Computational Data Analysis on Global Energy and COVID-19 Pandemic. International Journal of Information Engineering and Electronic Business.

[9]. Ahmad, N., Awan, M. J., Nobanee, H., Zain, A. M., Naseem, A., & Mahmoud, A. (2023). Customer Personality Analysis for Churn Prediction Using Hybrid Ensemble Models and Class Balancing Techniques. IEEE Access..

[10]. Kaur, N., Mittal, A., Lilhore, U. K., Simaiya, S., Dalal, S., & Sharma, Y. K. (2024). An adaptive mobility-aware secure handover and scheduling protocol for Earth Observation (EO) communication using fog computing. Earth Science Informatics, 1-18.

[11]. Rukhsar, S., Awan, M. J., Naseem, U., Zebari, D. A., Mohammed, M. A., Albahar, M. A., ... & Mahmoud, A. (2023). Artificial intelligence based sentence level sentiment analysis of COVID-19. Computer Systems Science and Engineering, 47(1), 791-807.

[12]. Sumit, Chhillar, R. S., Dalal, S., Dalal, S., Lilhore, U. K., & Samiya, S. (2024). A dynamic and optimized routing approach for VANET communication in smart cities to secure intelligent transportation system via a chaotic multi-verse optimization algorithm. Cluster Computing, 1-26.

[13]. Mahmoud, A., Awad, N. A., Alsubaie, N., Ansarullah, S. I., Alqahtani, M. S., Abbas, M., ... & Saber, A. (2023). Advanced deep learning approaches for accurate brain tumor classification in medical imaging. Symmetry, 15(3), 571.

[14]. Lilhore, U. K., Simaiya, S., Dalal, S., Sharma, Y. K., Tomar, S., & Hashmi, A. (2024). Secure WSN Architecture Utilizing Hybrid Encryption with DKM to Ensure Consistent IoV Communication. Wireless Personal Communications, 1-29.

[15]. Pundir, M., Sandhu, J. K., Gupta, D., Gupta, P., Juneja, S., Nauman, A., & Mahmoud, A. (2023). MD-MARS: Maintainability Framework Based on Data Flow Prediction Using Multivariate Adaptive Regression Splines Algorithm in Wireless Sensor Network. IEEE Access, 11, 10604-10622.

[16]. Lilhore, U. K., Dalal, S., Varshney, N., Sharma, Y. K., Rao, K. B., Rao, V. M., ... & Chakrabarti, P. (2024). Prevalence and risk factors analysis of postpartum depression at early stage using hybrid deep learning model. Scientific Reports, 14(1), 4533.

[17]. Radulescu, M., Dalal, S., Lilhore, U. K., & Saimiya, S. (2024). Optimizing mineral identification for sustainable resource extraction through hybrid deep learning enabled FinTech model. Resources Policy, 89, 104692.

[18]. Dalal, S., Lilhore, U. K., Radulescu, M., Simaiya, S., Jaglan, V., & Sharma, A. (2024). A hybrid LBP-CNN with YOLO-v5-based fire and smoke detection model in various environmental conditions for environmental sustainability in smart city. Environmental Science and Pollution Research, 1-18.

[19]. Lilhore, U. K., Dalal, S., Faujdar, N., Simaiya, S., Dahiya, M., Tomar, S., & Hashmi, A. (2024). Unveiling the prevalence and risk factors of early

stage postpartum depression: a hybrid deep learning approach. Multimedia Tools and Applications, 1-35.

[20]. Lilhore, U. K., Dalal, S., & Simaiya, S. (2024). A cognitive security framework for detecting intrusions in IoT and 5G utilizing deep learning. Computers & Security, 136, 103560.

[21]. Bishnoi, A., Bharadwaj, S., & Dalal, S. (2023, November). Disease Detection in Crop's using Transfer Learning: An analysis on Detection through Computer. In 2023 International Conference on Communication, Security and Artificial Intelligence (ICCSAI) (pp. 475-480). IEEE.

[22]. Singh, C. B., Gupta, N., & Dalal, S. (2024, February). Bug Predicting Survey Using Advanced Machine Learning Algorithms. In 2024 IEEE International Conference on Computing, Power and Communication Technologies (IC2PCT) (Vol. 5, pp. 1567-1570). IEEE.

[23]. Dalal, S., Seth, B., & Radulescu, M. (2023). Driving Technologies of Industry 5.0 in the Medical Field. In Digitalization, Sustainable Development, and Industry 5.0: An Organizational Model for Twin Transitions (pp. 267-292). Emerald Publishing Limited.

[24]. Dalal, S., Lilhore, U.K., Foujdar, N. et al. Next-generation cyber attack prediction for IoT systems: leveraging multi-class SVM and optimized CHAID decision tree. J Cloud Comp 12, 137 (2023). https://doi.org/10.1186/s13677-023-00517-4

[25]. Dalal, S., Lilhore, U. K., Simaiya, S., Sharma, A., Jaglan, V., Kumar, M., ... & Rana, A. K. (2023). Original Research Article A Blockchain-based secure Internet of Medical Things framework for smart healthcare. Journal of Autonomous Intelligence, 6(3).

[26]. Lilhore, U.K., Simaiya, S., Dalal, S. et al. A smart waste classification model using hybrid CNN-LSTM with transfer learning for sustainable environment. Multimed Tools Appl (2023). https://doi.org/10.1007/s11042-023-16677-z

[27]. Dalal, S., Lilhore, U. K., Manoharan, P., Rani, U., Dahan, F., Hajjej, F., ... & Raahemifar, K. (2023). An Efficient Brain Tumor Segmentation Method Based on Adaptive Moving Self-Organizing Map and Fuzzy K-Mean Clustering. Sensors, 23(18), 7816.

[28]. Lilhore UK, Manoharan P, Simaiya S, Alroobaea R, Alsafyani M, Baqasah AM, Dalal S, Sharma A, Raahemifar K. HIDM: Hybrid Intrusion Detection Model for Industry 4.0 Networks Using an Optimized CNN-LSTM with Transfer Learning. Sensors. 2023; 23(18):7856. https://doi.org/10.3390/s23187856

[29]. Lilhore, U. K., Dalal, S., Faujdar, N., Margala, M., Chakrabarti, P., Chakrabarti, T., ... & Velmurugan, H. (2023). Hybrid CNN-LSTM model with efficient hyperparameter tuning for prediction of Parkinson's disease. Scientific Reports, 13(1), 14605.

[30]. Dalal, S., Lilhore, U. K., Simaiya, S., Jaglan, V., Mohan, A., Ahuja, S., ... & Chakrabarti, P. (2023). Original Research Article A precise coronary artery disease prediction using Boosted C5. 0 decision tree model. Journal of Autonomous Intelligence, 6(3).

[31]. Deshwal D, Sangwan P, Dahiya N, et al. COVID-19 Detection using Hybrid CNN-RNN Architecture with Transfer Learning from X-Rays. Current Medical Imaging. 2023 Aug. DOI: 10.2174/1573405620666230817092337. PMID: 37594157.

[32]. Jaiswal, V., Saurabh, P., Lilhore, U. K., Pathak, M., Simaiya, S., & Dalal, S. (2023). A breast cancer risk predication and classification model with ensemble learning and big data fusion. Decision Analytics Journal, 100298.

[33]. Lilhore, U.K., Manoharan, P., Sandhu, J.K. et al. Hybrid model for precise hepatitis-C classification using improved random forest and SVM method. Sci Rep 13, 12473 (2023). https://doi.org/10.1038/s41598-023-36605-3

[34]. Dalal, S., Poongodi, M., Lilhore, U. K., Dahan, F., Vaiyapuri, T., Keshta, I., ... & Simaiya, S. Optimized LightGBM model for security and privacy issues in cyber-physical systems. Transactions on Emerging Telecommunications Technologies, e4771.

[35]. Dalal, S., Manoharan, P., Lilhore, U. K., Seth, B., Simaiya, S., Hamdi, M., & Raahemifar, K. (2023). Extremely boosted neural network for more accurate multi-stage Cyber attack prediction in cloud computing environment. Journal of Cloud Computing, 12(1), 1-22.

