MD MUSTAFIZUR RAHMAN

PhD Candidate | Human-Computer Interaction | MEXT Scholar
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Experiences

Kyoto University **March 2024 – Present**
Visiting Researcher | Prof. Goshiro Yamamoto Kyoto, Japan

- Collaborating with professors Goshiro Yamamoto, Chang Liu, and Hiroaki Ueshima from the Clinical Research Center for Medical Equipment Development.
- Involved in multidisciplinary projects focused on optimizing rehabilitation practices in physical therapy settings.
- Engaged in research titled "Generating Patient-Specific Abnormal Gait Motions for Therapists' Observational Skill Training" enhancing rehabilitation outcomes through advanced simulation techniques.

University of Trento **March 2025 – May 2025**
Visiting Researcher, MiRo Lab | Prof. Mariolino De Cecco Trento, Italy

- Completed a research internship under the supervision of Professor Mariolino De Cecco and Alessandro Luchetti, PhD at MiroLab , focusing on the development of Mixed Reality systems for industrial and rehabilitation applications.
- Developed a mixed-reality based serious game on HMD, integrating a collaborative robotic walker with a spatially aware AR interface.
- Validated the system through co-location between therapist and patient HMDs, synchronized with an external robotic walker to support adaptive gait rehabilitation.

SQA Engineer Lead | Talent Pro **June 2022 – August 2023**
Team Lead for Real Ezy Pte. Ltd., Singapore Dhaka, Bangladesh

- Led QA automation initiatives and improved testing efficiency across multiple projects.
- Designed and maintained automation frameworks with Selenium WebDriver, Appium, TestNG, and Cucumber (TDD/BDD).
- Developed and executed automated test scripts, ensuring high coverage and reliability.
- Performed API automation with REST Assured and GraphQL, plus performance, security, and database testing.
- Analyzed test results and collaborated with developers to quickly identify and resolve defects, enhancing product quality.

Education

Nara Institute of Science and Technology **October 2025 – Present**
PhD Candidate, Human–Computer Interaction,
Program of Information Science and Engineering Nara, Japan
Advisor: Prof. Hirokazu Kato

- **Research Topic:** Augmented Reality-Based General Task Support System Using Large Language Models for Context-Aware and Expertise-Adaptive Guidance

Nara Institute of Science and Technology **October 2023 – September 2025**
Master of Engineering, Program of Information Science and Engineering Nara, Japan
Advisor: Prof. Hirokazu Kato

- **Thesis:** Smart Rehabilitation for Augmenting Therapists' Skills: A Mixed Reality System for Simulating AI-Generated Patient-Specific Impaired Walking Motions and an Assistive Robotic Walker [Paper URL]

University of Rajshahi **January 2017 – December 2020**
Bachelor of Science in Information and Communication Engineering Rajshahi, Bangladesh
Advisor: Prof. Md. Emdadul Haque

- **Thesis:** Virtual Reality Based Medical Training Simulator and Robotic Operation System. [Paper URL]

Current Research

Augmented Reality-Based General Task Support System Using Large Language Models for Context-Aware and Expertise-Adaptive Guidance *Ongoing Research*

Advisors: Prof. Hirokazu Kato
Tech: Python | Unity (C#) | OpenXR | FastAPI | Large Language Models (GPT-based) | Retrieval-Augmented Reasoning | Pose Tracking | AR/MR Interaction | HMD

- Developing an AR system powered by LLMs and retrieval-augmented reasoning to deliver context-aware guidance for complex procedural tasks.
- Observes user actions, retrieves verified instructions from manuals, and generates expertise-adaptive AR guidance with explainability and real-time feedback.
- Applications include scientific experiments, medical device setup, and mechanical assembly workflows.

Generating Patient-Specific Abnormal Gait Motions for Therapists' Observational Skill Training *Ongoing Collaborative Research*

Advisors: Prof. Goshiro Yamamoto, Prof. Hirokazu Kato
Tech: Python (PyTorch) | Unity (C#) | Blender Python API | FastAPI | RVQ-VAE | Transformer Models | Motion Retargeting (TriLib, KeeMapRig) | HMD

- Developed an AI system that generates clinically meaningful impaired-gait animations from structured clinical text and visualizes them as 3D virtual patients for therapist training.
- Retrained the MoMask text-to-motion model on a curated gait-focused dataset and therapist-supervised recordings to capture asymmetric and pathological gait.
- Built a full pipeline including motion generation, Blender-based retargeting, and real-time visualization in Unity.

Peer-reviewed Conference

[C.1] Mariolino De Cecco, Giandomenico Nollo, Alessandro Luchetti, Matteo Bonetto, Damiano Fruet, Muhammad Irtaza, **Md Mustafizur Rahman**, Ryosuke Shigeto, Isidro Butaslac, "Robotic Collaborative Walker with Impedance Control and Augmented Reality for Assisted Walking and User Empowerment," in *2025 IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering (MetroXRAINE)*, ANCONA, Italy, October. 2025, Full Paper Pending Publication, doi:

[C.2] **Md Mustafizur Rahman**, Goshiro Yamamoto, Chang Liu, Hiroaki Ueshima, Isidro Butaslac, Taishi Sawabe, and Hirokazu Kato., "Experience Augmentation in Physical Therapy by Simulating Patient-Specific Walking Motions," in *16th Asia-Pacific Workshop on Mixed and Augmented Reality (APMAR 2024)*, Kyoto, Japan, Nov. 2024, vol 3907, doi:[paper link]

[C.3] **Md. Mustafizur Rahman**,Md Fatin Ishmam, Md. Tanvir Hossain, Md. Emdadul Haque, "Virtual Reality Based Medical Training Simulator and Robotic Operation System," in *2022 International Conference on Recent Progresses in Science, Engineering and Technology (ICRPSET)*, Rajshahi, Bangladesh, December 2022, pp. 1-4, doi:[10.1109/ICRPSET57982.2022.10188546]

Projects

Real–Time Feedback for Upper limb Motor Rehabilitation Using AR | *GitHub Code* | **C#| Unity | REST API**

- Developed an AR-based motor rehabilitation system integrating Azure Kinect for depth sensing and skeletal tracking, with real-time motion data transmitted via UDP/IP to HoloLens for interactive avatar visualization. Provided therapists and patients with immediate feedback on pose accuracy and performance scores, enabling immersive, precise guidance and monitoring to enhance motor skill rehabilitation.

Handwrite AI: Smart OCR for Handwritten Notes to Digital Text | **Python | PyTorch | FastAPI**

- Handwriting to Text OCR application converting scanned handwritten notes into digital text which is available for edits, search and stored in any platform. The application uses advanced Optical Character Recognition (OCR) techniques to accurately recognize and convert handwritten text from images or scanned documents into editable digital text. It can handle various handwriting styles, making it a versatile tool for students, professionals, and anyone who needs to digitize handwritten content.

Signature Authentication System: Improving Accuracy with AI and Biometrics | **Python | PyTorch | FastAPI**

- Recognition and verification of given signature by using image Processing and Machine Learning. The system uses a combination of image processing techniques and machine learning algorithms to accurately recognize and verify signatures, ensuring the authenticity of documents and preventing forgery.

Talks and Presentations

APMAR2024 **November 2024**
Paper Presenter | Experience Augmentation in Physical Therapy by Simulating Patient-Specific Motions Kyoto, Japan

ICRPSET2022 **December 2022**
Paper Presenter | Virtual Reality Based Medical Training Simulator and Robotic Operation System Rajshahi, Bangladesh

IEEE RAS Hackathon **November 2019**
Project Idea Presenter | Drone based flooded area mapping Dhaka, Bangladesh

Awards and Achievements

Monbukagakusho (MEXT) Scholarship – MEXT Scholarship Doctoral Student at NAIST **Oct. 2025–Sep. 2028, Japan**
Erasmus International Credit Mobility (ICM) Exchange Programme at University of Trento **March–May, 2025, Italy**
Monbukagakusho (MEXT) Scholarship – MEXT Scholarship Master's Student at NAIST **2023–2025, Japan**
Tech Genius Awards – Recognized for delivering the Best Performance as a Team Leader at TalentPro **2023, Bangladesh**
1st Runner-Up – IEEE RAS BUET Winter School Hackathon **2019, Bangladesh**
1st Runner-Up – LICT-JOB Fair Robotics Exhibition and Competition **2019, Bangladesh**

Technical Skills

Core Areas	XR (AR/VR/MR), Human–Computer Interaction (HCI), Artificial Intelligence, Large Language Models (LLMs), Generative AI
Research Methods	User study design, HCI evaluation, SUS, statistical analysis, Likert-scale analysis, qualitative coding
Programming	Python, C#, C/C++, Java, Bash, LaTeX
ML & DL	PyTorch, TensorFlow, scikit-learn; CNNs/RNNs/Transformers; training, evaluation, optimization
LLM & GenAI	Prompt engineering, retrieval-augmented generation (RAG), lightweight fine-tuning (LoRA/PEFT), inference pipelines
XR & 3D	Unity (Quest/HoloLens), Blender Python API, Kinect; scene understanding and interaction
APIs & Back-end	FastAPI, REST, WebSockets, MQTT
DevOps & Tools	Docker, Git, GitHub/GitFlow, Linux/Unix, Jira
Web	HTML, CSS, JavaScript; PHP/Laravel (working knowledge)
Databases	PostgreSQL, MySQL
Testing & QA	Selenium, Appium, Postman, JMeter, pytest/JUnit

Training Courses

Skill Development for AR, VR, MR Technology — ICT Center, University of Rajshahi **Apr.–May, 2019**
Skill Development for Arduino & Robotics — Multitech, Rajshahi **Mar.–May, 2019**
Skill Development for Mobile Game & Application — ICT Division, Texlab Rajshahi **Jun.–Nov., 2018**

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