College of Engineering and Technology

Project Work/Internship – Student Handbook

Project Batch ID
CIN_218

Name of student	Register Number	Department	Mobile Number	Email ID
Krishna Kant Pandey	RA2011026010288	CINTEL	7380549005	kp9827@srmist.edu.in
Bhavani Shankar Ajith	RA2011026010300	CINTEL	9892250244	as3246@srmist.edu.in

Degree/ program	B.Tech	**Specialisation**	Computer Science & Engineering with specialisation in Artificial Intelligence & Machine Learning
Academic Year	2023-2024 (Even)	**Semester**	8
Course Code	18CSP109L	**Course Title**	Major Project

Working Title of the Project:	**Exploring The Solar System with Machine Learning Agents Via Deep Reinforcement Learning in Unity**
Project Site / Location	Chennai
Name and address of the company / organisation (Applicable for projects with industry or industry support)	SRM IST, Kattankulathur, Chengalpattu District-603203

Supervision Team

	Supervisor	Co-Supervisor	External Supervisor (If applicable)
Name	**Dr. G. Vadivu**		
Designation	**Professor**		
Department	**DSBS**		
Campus	Kattankulathur		
Telephone	9841217971		
E-mail	vadivug@srmist.edu.in		

Problem (or) Product Description -
With advancements in artificial intelligence and interactive simulation technologies, we have developed an innovative spaceship simulation leveraging Unity's powerful gaming engine and ML-Agents equipped with Deep Reinforcement Learning (DRL) using Proximal Policy Optimization (PPO). This state-of-the-art project introduces a sophisticated spaceship agent, designed to master complex navigation and identification tasks within a meticulously crafted solar system. As the agent explores this dynamic environment, it learns to track and approach celestial bodies, adapting its strategies through real-time interactions. This simulation not only exemplifies the application of cutting-edge AI in understanding orbital mechanics but also serves as a versatile educational tool, enhancing learning through immersive virtual experiences.
Assumptions and Constraints - Assumes stable physics, limited computational resources.
Stakeholders - Krishna Pandey, Bhavani Shankar, Dr. G. Vadivu, Dr. S. Karthik

Division of work and contributors

Time period		Activities or components of the project	Name/Register Number of the Individual Contributor	Names/Register Number of the Joint Contributors
From Date	To Date			
15/11/23	19/11/23	Looking for project ideas	Krishna Pandey	-
15/11/23	19/11/23	Looking for project ideas	Bhavani Shankar	-
20/11/23	20/11/23	Finalising the project idea	Bhavani Shankar	Krishna Pandey Bhavani Shankar
06/01/24	07/01/24	Specific application for project	Bhavani Shankar	-
08/01/24	10/01/24	Setting up of the Software	Krishna Pandey	-
20/01/24	01/02/24	Environment Design	Bhavani Shankar	-
02/02/24	07/02/24	Agent Design	Krishna Pandey	-
09/02/24	15/02/24	Learning Algorithm Configuration	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar
21/02/24	25/02/24	Training Sessions Performance Evaluation	Bhavani Shankar	-
25/02/24	28/02/24	User Interface Development	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar
01/03/24	03/03/24	Documentation	Krishna Pandey	-
03/03/24	12/03/24	Quality Assurance and Testing Starting up of Base Paper	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar

10/03/24	20/03/24	Completing the Graphical User Interface and getting ready	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar

Division of work and contributors

Time period		Activities or components of the project	Name/Register Number of the Individual Contributor	Names/Register Number of the Joint Contributors
From Date	To Date			
10/03/24	16/03/24	Rough draft of report	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar
13/03/24	17/03/24	Rough draft of the research paper	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar
19/03/24	22/03/24	Final Research Paper	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar
23/03/24	25/03/24	Questing for Conferences	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar
25/03/24	26/03/24	Applied for an IEEE Explorer Conference	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar
21/04/24	30/04/24	Final Major Project Report and Submission	Krishna Pandey Bhavani Shankar	Krishna Pandey Bhavani Shankar

Summary record of major progress meetings with supervisors

Summary record of major progress meetings with supervisors			**Working title of dissertation/research project:** **Exploring The Solar System with Machine Learning Agents Via Deep Reinforcement Learning.**	
Meeting date & supervisors present	**Progress since last meeting**	**Agreed programme of work and target dates**	**Other issues, e.g. facilities, supervision, training needs, etc.**	**Date of next meeting**
20/11/23	-	Deciding project title and abstract	Finding unique application	23/11/23
18/01/24	Initital team briefing completed, project initiated	Environment design completion: due in 2 weeks Agent and Initial Training setup:due in 4 weeks	Introduction to Unity and ML Agents for team members. Assign project leads for each major component	23/02/24
23/02/24	Basic Environment and initial spaceship model created. Software setup and configuration completed	Begin AI training: Start in 1 week. First Prototype testing: due in three weeks.	Review individual contributions and adjust roles if necessary. Focus on final testing and Bug Fixes.	23/03/24

Summary record of major progress meetings with supervisors

Summary record of major progress meetings with supervisors			**Working title of dissertation/research project:**	
Meeting date & supervisors present	**Progress since last meeting**	**Agreed programme of work and target dates**	**Other issues, e.g. facilities, supervision, training needs, etc.**	**Date of next meeting**
23/03/24	Completed AI training and testing. UI Improved and additional interactive features addeed	Completion and submission of draft of Major Project Report	Publishing Research Paper	23/04/24
23/04/24	Submitted hard copy of Major Project Report	Final Viva and submitting remaining documents	-	15/05/24

Worksheet / Data collection / Observation etc

1) Performance Metrics:

Our spaceship simulation utilizes key performance metrics to evaluate effectiveness, including the agent's precision in tracking celestial bodies, navigation speed to targets, and collision avoidance. We also monitor system response time and resource use to ensure optimal operational efficiency. These metrics are vital for ongoing improvements and achieving our objectives in educational engagement and learning outcomes.

2) Comparison:

Our AI-driven spaceship simulation significantly outperforms previous models that relied on more deterministic AI methods. Using DRL with PPO, the spaceship agent exhibits dynamic, adaptable behaviors, enhancing its ability to manage unexpected obstacles and changes in the environment. This showcases the benefits of integrating advanced machine learning into our simulation, as observed through rigorous testing.

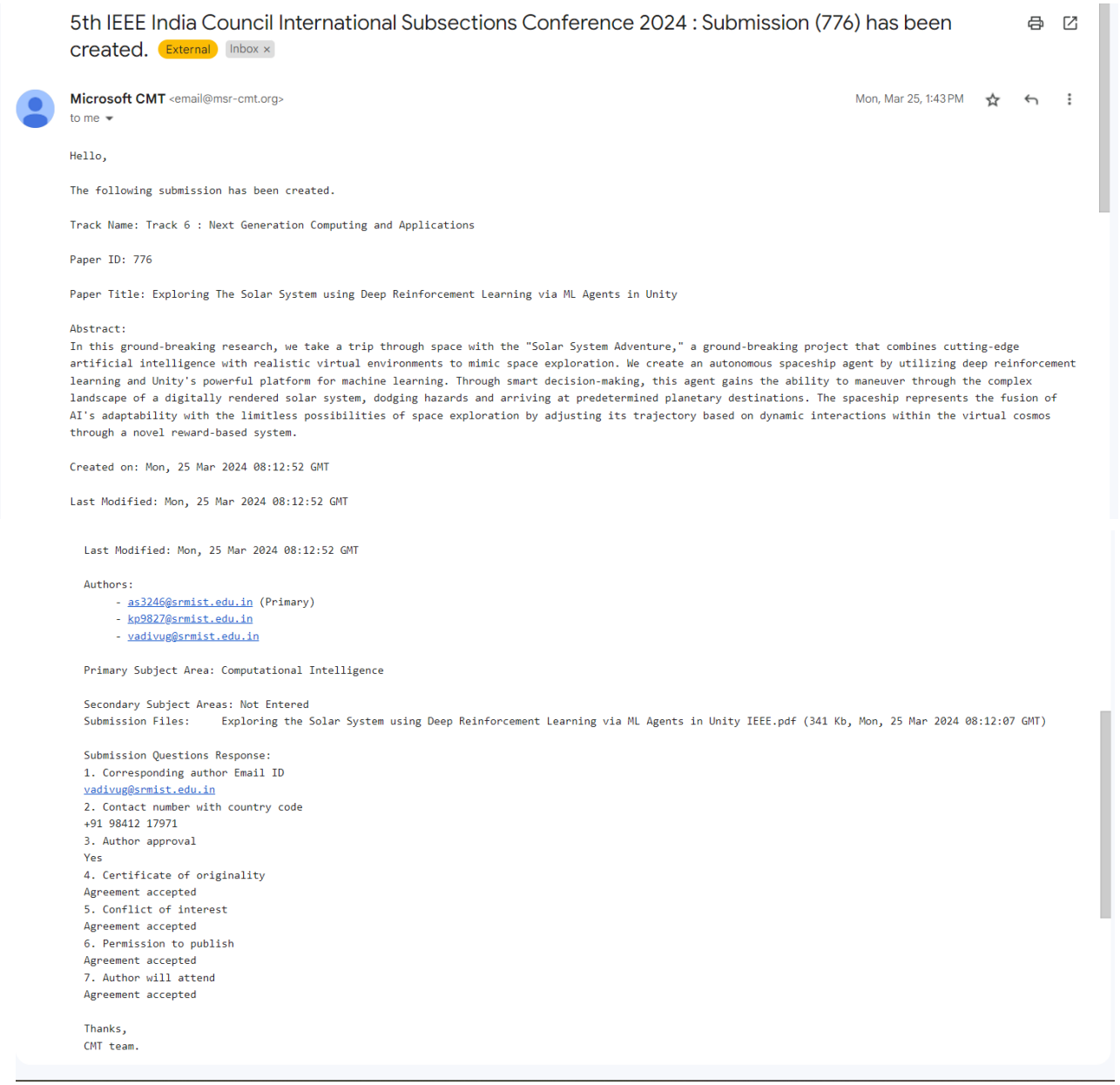
3) Advantages Over Existing Model:

The latest model of our spaceship simulation offers considerable advancements over earlier versions, chiefly through the integration of ML-Agents and a DRL framework. This combination enhances the spaceship's decision-making capabilities within complex scenarios, a leap forward from prior capabilities. The system's scalability and flexibility also support easy updates and expansions, making it a versatile tool for both educational and advanced AI applications.

4) System Upgrade:

Recent upgrades to our spaceship simulation system include a more sophisticated graphical interface for clearer visualization of the spacecraft’s trajectory and environment. Enhancements in data processing have reduced latency and improved interaction realism, ensuring the simulation remains on the technological forefront. These improvements provide a more immersive and detailed user experience.

Conference Submission Details



5th IEEE India Council International Subsections Conference 2024 : Submission (776) has been created. External Inbox ×

Microsoft CMT <email@msr-cmt.org> Mon, Mar 25, 1:43 PM
to me

Hello,

The following submission has been created.

Track Name: Track 6 : Next Generation Computing and Applications

Paper ID: 776

Paper Title: Exploring The Solar System using Deep Reinforcement Learning via ML Agents in Unity

Abstract:
In this ground-breaking research, we take a trip through space with the "Solar System Adventure," a ground-breaking project that combines cutting-edge artificial intelligence with realistic virtual environments to mimic space exploration. We create an autonomous spaceship agent by utilizing deep reinforcement learning and Unity's powerful platform for machine learning. Through smart decision-making, this agent gains the ability to maneuver through the complex landscape of a digitally rendered solar system, dodging hazards and arriving at predetermined planetary destinations. The spaceship represents the fusion of AI's adaptability with the limitless possibilities of space exploration by adjusting its trajectory based on dynamic interactions within the virtual cosmos through a novel reward-based system.

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Primary Subject Area: Computational Intelligence

Secondary Subject Areas: Not Entered
Submission Files: Exploring the Solar System using Deep Reinforcement Learning via ML Agents in Unity IEEE.pdf (341 Kb, Mon, 25 Mar 2024 08:12:07 GMT)

Submission Questions Response:
1. Corresponding author Email ID
vadivug@srmist.edu.in
2. Contact number with country code
+91 98412 17971
3. Author approval
Yes
4. Certificate of originality
Agreement accepted
5. Conflict of interest
Agreement accepted
6. Permission to publish
Agreement accepted
7. Author will attend
Agreement accepted

Thanks,
CMT team.