American International University-Bangladesh (AIUB)

Department of Computer Science

Faculty of Science & Technology (FST)

PROJECT TITLE

Robo Hatch - A Robotics Development Platform

This Software Engineering Project Submitted
By

Semester: Fall_24_25		**Section:**	**Group Number:**	
SN	Student Name	Student ID	Contribution (CO3)	Individual Marks
1	Dip Khastagir	23-50346-1	20%	
2	Md Shahriar Jaman	23-50382-1	20%	
3	Mushfika Rahman Nijhum	23-50393-1	20%	
4	Basudeb Kundu	23-50856-1	20%	
5	Dipu Roy	23-50420-1	20%	

The project will be evaluated for the following Course Outcomes

CO3: *Select* appropriate software engineering models, project management roles, and their associated skills for the complex software engineering project and evaluate the sustainability of developed software, taking into consideration the societal and environmental aspects	Total Marks	
Appropriate Process Model Selection and Argumentation with Evidence	[5 Marks]	
Evidence of Argumentation Regarding Process Model Selection	[5Marks]	
Analysis of the impact of societal, health, safety, legal, and cultural issues	[5Marks]	
Submission, Defense, Completeness, Spelling, grammar, and Organization of the Project report	[5Marks]	
CO5: Perform as an effective team member or leader in diverse team settings and solve multi-disciplinary problems in the computer science and engineering domain	Total Marks	
Taking project responsibility: perform assigned tasks on time independently	[5 Marks]	
Contribution to project group meetings, sharing fruitful ideas	[5Marks]	
Positive attitude towards group work, collaboration, compromise, helping others to understand their project work responsibility	[5Marks]	
Showing respect and value towards other team member's opinion	[5Marks]	

Description of Student's Contribution in the Project work

Student Name: **Dip Khastagir**
Student ID: 23-50346-1
Contribution in Percentage (%): 20%
Contribution in the Project:

- Contribution Description 1
  Project Proposal & Background of the Problem: The robotics industry is expanding rapidly across various sectors, but development is hindered by fragmentation among professionals working in hardware, software design, and testing. The lack of a unified platform leads to poor collaboration, project delays, and increased costs. Additionally, talented freelancers face limited job opportunities due to distance and the absence of specialized marketplaces. Hardware prototyping remains costly for small innovators, and without standardized processes, many robotics projects fail to reach completion or commercialization. This fragmented structure restricts innovation, causes startup failures, and results in the underutilization of skilled professionals.
- Contribution Description 2
  Technical Architecture and Risk Handling**:** Outlined how the Spiral Model handles risk identification, legal compliance, and AI integration. Described technical needs such as CI/CD pipelines, encryption, data privacy, and system scaling.

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Signature of the Student

Student Name: **Md.Shahriar Jaman**
Student ID: 23-50382-1
Contribution in Percentage (%): 20%
Contribution in the Project:

- Contribution Description 1
  Technical Feasibility & Scientific Contribution: Defined use of AI, cloud computing and secure transactions in order to guarantee feasibility. Authored the Scientific Contribution section summarizing impact of the platform on the innovation in robotics. Standard operating procedures and quick prototypes tools for robotics teams (proposed).
- Contribution Description 2

Role Identification and Responsibility Allocation : Defined all project roles such as Project Manager, Analyst, Developers, AI Engineer, and Security Analyst. Ensured role-based clarity for efficient team management and structured development execution.

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Signature of the Student

Student Name: **Mushfika Rahman Nijhum**
Student ID: 23-50393-1
Contribution in Percentage (%): 20%
Contribution in the Project:

- Contribution Description 1
  Societal Impact & Target User Analysis: Described societal, legal, health, and cultural impacts of the platform. Defined the target user groups including freelancers, teams, and companies. Explained the benefits to users and emphasized global collaboration and ethical engagement.
- Contribution Description 2
  Process Mode land Comparison**:** Researched and selected the Spiral Process Model as the best fit for the Robo Hatch platform. Analyzed and compared alternative models like Waterfall, Agile, V-Model, and Incremental to justify the selection.

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Signature of the Student

Student Name: **Basudeb Kundu**
Student ID: 23-50856-1
Contribution in Percentage (%): 20%
Contribution in the Project:

- Contribution Description 1
  Literature Review & Existing Solutions Analysis: Conducted extensive research on existing freelancing and robotics platforms. Performed comparative analysis and identified gaps in current systems like Upwork, GrabCAD, and GitHub. Contributed to the Literature Review and Existing Software Solutions sections of the proposal.
- Contribution Description 2
  Impact Identification and Analysis: Identified and explained platform impact across freelancers, companies, researchers, and the tech industry

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Signature of the Student

Student Name: **Dipu Roy**
Student ID: 23-50420-1
Contribution in Percentage (%):20%
Contribution in the Project:

- Contribution Description 1
  Functionalities Planning: Planned and described all core functionalities including account types, AI features, and escrow system. Designed the flow for project lifecycle management and team/company collaboration modules. Focused on feasibility, user roles, and system structure across all development phases
- Contribution Description 2

User Interaction : Focused on user experience design, interface simplicity, and interaction flow for freelancers and companies

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Signature of the Student

Project Proposal

1.1 Background of the Problem

The robotics industry shows fast expansion through technological advancements that cover healthcare and manufacturing and agriculture and entertainment purposes in recent years. The rising demand for robotic solutions produces important hurdles during the development cycle. The primary development obstruction in robotics stems from professionals within hardware, software, design and testing fields who work independently in diverse organizations. Multiple developmental stages between teams lead to performance issues and delayed schedules as well as making collaboration throughout the entire project timeline challenging.

Root Cause of the Problem: Robotic technology has progressed notably throughout the years, which caused advancements across automation technology and artificial intelligence along with industrial implementation. The industry persists in confronting substantial problems which produce obstacles toward innovation and commercialization advancement. Product development delays from initial ideas through production stages represent the main limiting factor for the robotics industry. Robotics development fragments naturally because professionals dividing themselves among mechanical design, software development, artificial intelligence and electronic engineering work independently from each other. Without proper integration between teams programming costs become elevated while project completion needs longer durations.

The robotics industry faces a primary challenge because it lacks an organized marketplace which enables freelancer professionals to work hand in hand with startups as well as established companies. Robotics professionals with talent encounter employment difficulties because they face distance restrictions combined with insufficient specialized platforms for their industry
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The key process of hardware prototyping for robotics development remains too costly for independent innovators and small companies. Standardized processes aimed at integrating robotics development aspects do not exist which result in project failures.

Impact on the Industry: The parts-based organization of the robotics industry generates significant negative effects. Standing innovation at bay appears as the most critical disadvantage because promising concepts often perish because of insufficient resources combined with a shortage of qualified personnel. Robotic startup failures occur due to financial problems alongside insufficient development guidance during their initial operational period. Groundbreaking research discoveries remain isolated in laboratories since they fail to enter the commercial market as marketable products. The underusage of available talent represents a significant problem amongst robotics professionals. The lack of suitable project assignments for skilled professionals creates

career stagnation by diminishing their professional advancement as well as withholding field-related .

1.2 Solution to the Problem

Objective: The objective of Robo Hatch is to create an integrated platform that brings together freelancers and companies in the robotics industry. By leveraging state of the art technologies, Robo Hatch aims to streamline the development of robots by facilitating seamless collaboration across different stakeholders.

Proposed Solutions: A structured robotics development marketplace exists as the proposed solution for resolving these challenges. The platform integrates all robotics development activities by allowing professionals to work with startups and companies who collaborate on planning stages alongside designing and prototyping and programming and testing and deployment and maintenance procedures. The platform applies artificial intelligence functions to provide recommendations about freelancers along with outsourcing partners that fit project needs. The platform will assist organizations to discover appropriate candidates which minimizes their expenses in talent recruitment.

The marketplace introduces pricing arrangements to help businesses lower their expenditures for prototype development and hardware testing. Through this process companies can delegate development work to expert professionals who will operate under their project oversight. The platform will use an escrow system which protects secure financial transactions between buyers and sellers and avoids fraudulent transactions. The platform develops a research and development hub specific to robotics which enables businesses to work together on innovations and speed up their robot commercialization process.

Functionalities: Through its main offerings the platform enables users to achieve complete collaboration with step-by-step innovation functions.

- **Freelancer Accounts:**

Robotics professionals who are planners, 3D model designers along with software developers can make account registrations that enable them to list their services. Through the platform freelancers can offer their research papers as well as their 3D designs together with software codes and other development assets for purchase to companies which need help in their projects.

- **Team Accounts:** The platform offers registration access for robotics project teams. The minimal team membership must exceed ten members because it enables teams to possess both essential expertise and a large-scale workforce needed for significant robotics development responsibilities. Every team have the ability to provide specialized services while testing and debugging and integrating robotic systems thus enabling their participation in projects without establishing a formal company. The absence of direct product selling rights does not prevent them from delivering essential development and troubleshooting services.

- **Company Accounts:** The robotics research, prototyping and commercialization businesses can open validated accounts through the platform interface. Complete marketplace access will be available to these companies so they can both hire freelancers as well as acquire research and assign robotics development tasks to external providers.

Companies through this platform can market their robotics products after innovation development finishes to enable commercial operational expansion of their new technologies.

- **AI-Powered Recommendations:** The matchmaking system for professionals to find projects benefits from artificial intelligence optimization as its primary function. The system uses AI to examine project demands then generate recommendations about the ideal candidates between freelancers and outsourcing partners. The system will allow companies to discover local production centers for prototyping and deployment essentials to decrease their cost structure.

- **Project Lifecycle Management:** Project lifecycle management tools will operate at full transparency and maximum efficiency on the platform. The platform allows teams to track project developments through combination of video logs and reporting features and milestone updates. Platform users will receive features which allow them to embed software programs directly into physical test models for checking integration points and operational needs. Testing teams along with debugging personnel will confirm projects for safe deployment through validation processes thereby reducing the chance of system flaws.

Feasibility of the Solution: As it makes use of modern technologies such as artificial intelligence, cloud computing, and secure online transactions, the proposed approach is theoretically feasible. Financially, the platform will enable freelancers, teams, and organizations to make money by providing services while also earning commissions on good transactions. The system is also extremely expandable, since it can enable worldwide collaboration, reach new industries, and connect other features like robotics certifications**.**

Impact on Societal, Health, Safety, Legal, and Cultural Issues: The platform will be very important in several different areas. From a society point of view, it will open employment for robotics experts and help robotics innovation expand. Regarding health and safety, it will encourage the creation of automated solutions to lower human intervention in dangerous environment so improving workplace safety. Legally, it will create a disciplined framework to control contracts, protect intellectual property, and control transactions. Culturally, the platform will support worldwide cooperation by grouping experts from many backgrounds to work on innovative robotics projects. The impact of Robo Hatch will be deep-seated in many ways.

- **Social Impact:** By facilitating it to be easier for freelancers to collaborate with corporations, Robo Hatch can make the global robotics industry expand, allowing for quicker breakthroughs and robots at affordable prices. It can enable individuals to become capable of selling their expertise remotely, their advantage as well as the corporations with whom they collaborate.
- **Health & Safety:** Robots are being applied more and more in areas like healthcare (surgical robots, elderly care robots) and industrial automation. Robo Hatch's platform will ensure quality and safety standards are upheld, helping to create robots enhancing human life while minimizing risks.

- **Legal and Cultural Issues:** The platform will be based on international labor laws to provide an ethical and transparent work culture. Besides, it will allow cross-cultural interaction through uniting companies and freelancers from different countries and helping them share knowledge.

Target Group of Users: The platform is designed for different numbers of users, including freelancers working with robotics planning, 3D modeling, and software development. It also will serve teams engaged in robotics research, prototyping, testing, deployment, and maintenance. The products of the platform will also help companies obtaining market-ready robotics solutions.
Benefits to Users: Freelancers working on a worldwide marketplace in which they can sell their skills and research, while companies will benefit from a streamlined development process without a huge overhead. Teams will have the ability to work together, within the context of robotic projects, without needing to invest significant resources up front. Because it will help customers with pre-tested, validated and ready-to-employ robotics solutions.

Scientific Contribution: The platform supports scientific developments through standard operating procedures for robotic development. Different engineering disciplines will improve collaboration through the platform alongside AI-based project optimization by matching engineering teams. The platform enables fast prototyping along with testing support which stimulates emerging technology development leading to the quickest possible innovation in robotic systems.

Literature Review: The robotics development sector has witnessed considerable expansion with a lot of platforms that facilitate interaction between professionals and companies. Most existing solutions primarily address freelancing services as a whole, such as Upwork and Fiverr, that provide a platform for the hiring of talent. These platforms lack a dedicated system for robotics development, wherein there is in-depth technical cooperation over multiple stages, from designing to deployment. Certain industry-specific platforms, such as GrabCAD for 3D modeling and GitHub for software development, mitigate certain aspects of robotic development but fail to provide a complete integrated workflow for both hardware and software integration.

Robo Hatch seeks to fill this vacuum by offering a specialist platform that simplifies the whole robotic development process. Unlike traditional freelancing websites, it facilitates structured project collaboration such that companies can transition from concept to launch with ease by engaging the appropriate specialists at each step. Through AI-driven suggestions, team building, and real-time collaboration tools, Robo Hatch extends the scope of existing solutions and provides a more efficient and scalable method of robotics project management.

Existing Software Solutions: There exist several software solutions that are presently available to address different areas of robotics development. Computer-aided design software like AutoCAD and SolidWorks is usually used for designing robot parts, while freelance sites like Upwork and Fiverr allow companies to look for specialists in many areas. Further, project management software like Trello and Asana help to monitor progress and workflow management. But these solutions are independent of each other, resulting in inefficiencies in collaboration and coordination. Robo Hatch seeks to build upon these available solutions by creating a single platform that integrates freelance services with corporate collaboration seamlessly so that there is

improved coordination in all phases of robot development. It will introduce AI-driven matchmaking to pair the right professionals with projects, incorporate expert tools tailored for robotics development, and offer local services to allow companies to scale production efficiently.

Conclusion: The proposed platform serves the purpose of connecting robotics planning activities to prototypes through software development before releasing products for commercialization. The implementation of AI recommendations together with secure transactions and outsourced support functions will develop a cost-efficient robotics development environment. The established collaboration approach provides assistance to freelancers and corporations along with teams and supports robotic innovation worldwide**.**

Software Development Life Cycle

Process Model

Selected Model for Robo Hatch: **Spiral Process Model**

We selected the Spiral Model for our Robotics Project Platform because it features adjustable design while maintaining risk management order and multiple iteration capabilities. The platform combines three user groups (freelancers, companies and administrators) while requiring steady platform development and user feedback admission. The Spiral Model enables phased development which permits evaluations along with risk analysis at short intervals.

Comparison with other models (Why not other models for Robo Hatch?)

Waterfall Model:

- Reason not suitable: The process has limitations because it operates with strict sequential direction. Any phase that ends becomes resistant to alterations which must be harder to implement.
- Impact on our project: The Robotics Platform must deal with frequent updates because it requires dynamic user responses. A multi-user evolving system requires iterative feedback and modifications since the Waterfall Model does not provide these capabilities.

Agile Model:

- Reason Not Suitable: Agile promotes flexibility and quick iteration but lacks formal documentation and strong risk management.
- Impact on Our Project: The project faces restrictions due to legal and national requirements such as GDPR and IP laws that need structured planning and traceable documentation which could be compromised by Agile.

Incremental Model:

- Reason Not Suitable: The method lacks an effective risk management framework that should be implemented from the start of development.
- Impact on Our Project: The assessment of potential dangers including legal requirements and payment security and user data privacy protection should take place in advance of both platform development and individual feature implementation.

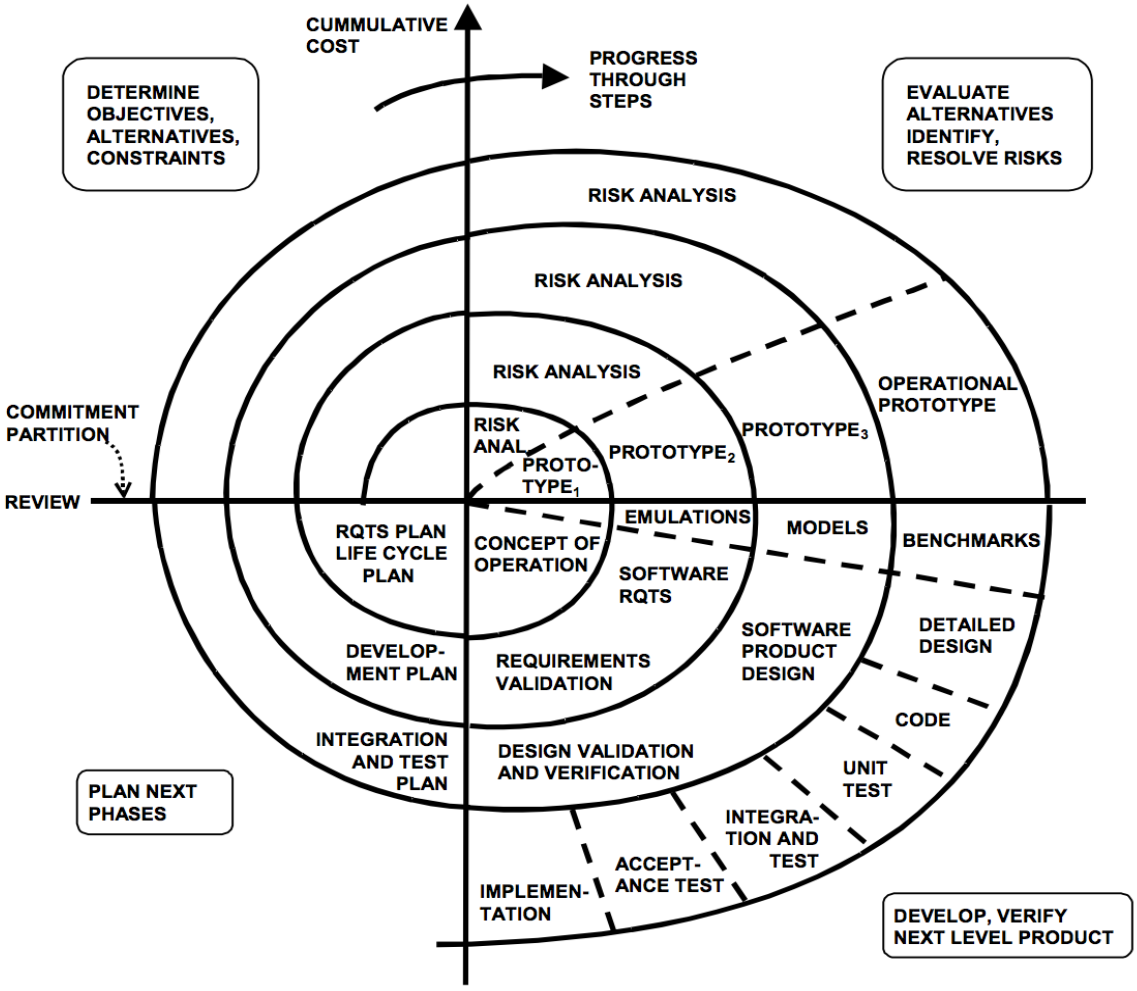
V-Model:

- Reason Not Suitable: The V-Model enforces rigid planning and assumes all requirements are fixed from the beginning.

- Impact on our project: Evolution of requirements needs to be enabled by the Robotics Platform according to emerging technologies and user feedback, but the V-Model lacks this capability.

Advantages of the Spiral Model for Robo Hatch

- Iterative Development: The system builds progressively through successive iterations to introduce programming steps that start with AI recommendations followed by project
- tracking capabilities and secure messaging functions.
- Risk Management: Each spiral cycle entails both the discovery of possible risks including legal problems and data security incidents and system capability failures and their subsequent prevention measures.
- User Feedback Integration: A continuous feedback loop from stakeholders directs the future development steps to improve the system by implementing actual organizational requirements.
- Support for Complex Systems: The Spiral Model serves projects featuring massive development risks where artificial intelligence (AI) meets cloud platforms along with user interface integration.



Role identification and responsibility allocation

Role	Responsibilities
Project Manager	The project leader guarantees both task completion deadlines and achievement of milestones while maintaining team-wide communication.
System Analyst	Collects requirements, interprets user needs, and translates them into technical documentation.
UI/UX Designer	Designs user-friendly interfaces that reduce complexity and improve task efficiency.
Frontend Developer	Implements responsive and functional user interfaces using React or ASP.NET Razor Pages.
Backend Developer	Secure implementation of APIs and data integration, server-side programming logic along with business logic elements will follow.
Database Administrator	The implementation of data models and schemas by the data engineer ensures secure storage of users, projects, payments together with transactions.
AI/ML Engineer	Trains and maintain recommendation algorithms for project-user matching.
Quality Assurance (QA)	Performs manual and automated testing using tools like Selenium; ensures feature integrity before releases.
DevOps Engineer	Handles cloud deployment (AWS/Azure), CI/CD pipelines, and system scaling.
Security Analyst	Ensures GDPR compliance, data encryption, and role-based access controls.

Impact Identification

Freelancer:

- Defined project development stages (displaying design then prototype and deployment sections) can be accessed for verification.
- The system provides AI-generated project-to-skills-history recommendations.

Companies:

- Streamlined hiring and collaboration process.
- Centralized platform reduces time and costs for prototyping and delivery.

Industry impact:

- Facilitates legal and technical collaboration among verified entities.
- The platform promotes both modular robotics advancement together with shared innovation projects.

Student and researchers:

- Exposure to real-world applications and professional environments.
- Opportunities to monetize research and gain experience.

Economic impact:

- Boosts local tech economies by connecting talent to demand.
- Secure and legal outsourcing within national boundaries reduces risk

Technological impact:

- Encourages real-world AI use in project matchmaking.
- Cloud-native development for scalable robotics infrastructure.

Conclusion

The Spiral Model best suits the Robotics Project Platform because it effectively balances control measures with flexibility and continuous development needs.

References

- **AIUB Software Engineering lab manual.**
- **Boehm, B. (1988). A Spiral Model of Software Development and Enhancement.**
- **Sommerville, I. (2016). Software Engineering, 10th Edition.**
- **Pressman, R. S. (2014). Software Engineering: A Practitioner's Approach.**
- **Agile Alliance: https://www.agilealliance.org/agile101/**
- **ISO/IEC 29110: Systems and Software Engineering — Lifecycle Profiles for Very Small Entities**

Text Format:

- Style: Times New Roman
- Size: 12
- Space: 1.0
- Alignment: Justify
- Length: Maximum 6 pages (including cover page)

Rubric for Project Assessment (CO3)

Criteria	Marks distribution (Max 3X5= 15)				Acquired Marks
	Inadequate (1-2)	Satisfactory (3)	Good (4)	Excellent (5)	
Selection of Software Engineering Models	Does not articulate a position or argument of choosing appropriate model. Does not present any evidence to support the arguments for the choice of the model	Articulates a position or argument for choosing models that is unfocused or ambiguous. Presents incomplete/vague evidence to support argument for model choice	Articulates a position or argument of choosing models that is limited in scope. Does not present enough evidence to support the argument for the choice of the model	Clearly articulates a position or argument for the choosing software engineering models. Presents sufficient amount of evidence to support argument for the model selection	
Role identification and Responsibility Allocation	The project has poor project management plans for identifying roles and assigning the responsibilities	Identify few roles in the project management where some of the roles are left alone with any project responsibilities	Identify most of the roles in the project management and assign their responsibilities	Well planned project with proper role identification and responsibility allocation in the project management activities	
Impact identification					
Formatting and Submission	Project report is not complete and Several errors in spelling and grammar. Present a Confusing	Some errors in spelling and grammar. Some problems	Few errors in spelling and grammar. Presents most of the details in	Project report is complete and No errors in spelling and grammar. Consistently	

	organization of concepts, supporting arguments, and real-life example. Sentences rambling, and details are repeated.	of organizing the answer in a logical order of defining, elaborating, and providing real-life examples.	a logical flow of organization in definition, details, and example.	presents a logical and effective organization of definition, details, and real-life example of the topic.	
				Acquired marks:	
				CO Pass / Fail:	

CO5 [PO-i-2]: Perform as an effective team member or leader in diverse team settings and solve multi-disciplinary problems in computer science and engineering domain.				
Assessment Attribute/Criteria	**Missing/ Incorrect (0)**	**Inadequate (1)**	**Satisfactory (2)**	**Excellent (3)**
Taking responsibility	Does not perform assigned tasks; often misses meetings and, when present, does not have anything constructive to say; relies on others to do the work;	Partially performs all assigned tasks; attends meetings irregularly and occasionally participates and hence not reliable;	Performs all assigned tasks; attends meetings regularly and usually participates effectively. generally reliable;	Performs all tasks very effectively; attends all meetings and participates enthusiastically; very reliable.
Contributions	Never provides useful ideas when participating in a group discussion	Rarely provides useful ideas when participating in a group discussion	Sometimes provides useful ideas when participating in a group discussion	Routinely provides useful ideas when participating in a group discussion
Collaboration and Ability to Compromise	Not cooperative, unable to compromise and disrupts the team process.	Sometimes cooperative, and rarely displays a positive attitude.	Usually cooperative, able to compromise and generally display positive attitude.	Always cooperative. Willingness to compromise. Always display positive attitude.
Valuing other	Often argues with teammates; doesn't let anyone else talk;	Seldom listens to others' points of view; occasionally	Generally, listens to others' points of view; always uses	Always listens to others and their ideas; helps them develop their ideas

team members (Working with others)	occasional personal attacks and "put-downs"; wants to have things done his way and does not listen to alternate approaches.	behaves in an oppressive manner; tries to force their own ideologies on other.	appropriate and respectful language; tries to make a definite effort to understand others' ideas.	while giving them full credit; always helps the team reach a fair decision.