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Research Article

Agent Based Intelligent System for Enhanced Teamwork Performance

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Abstract

It is impossible to overstate the necessity of a strategic and practical approach in the workplace in order to maximize productivity these days. Teamwork is one of the best ways to adapt to the changes that have occurred in today's environment throughout time. In every industry, the optimum performance arrangement for realizing visions, carrying out plans, and accomplishing objectives is teamwork. It is also one of the most crucial components of systems for continuous improvement since it makes information exchange, issue resolution, and the growth of employee accountability easier. Teams function as a grouping of people with complementary talents who work together rather than against one another. They are held accountable for their strategic methods and use them to achieve a shared objective. The Supervised Learning technique was used in this work to simulate team performance utilizing an intelligent coaching agent. Through the use of an automated performance assessment and weighted scores for each task, this study was able to create a system that will remove biases from performance evaluation. As soon as a worker does the task, they will obtain a score. The purpose of this study was to demonstrate an event-based performance approach by developing and utilizing an intelligent coaching agent in a supervised learning team training framework. The goal was successfully met, and the result shows positive impacts on the team's performance.

Keywords

Intelligent Agent, Artificial Intelligence, Task, Teamwork, Performance, Intelligent Tutoring System, Supervised Learning

1. Introduction

Although the majority of people wouldn't give intelligent agents a second thought for the work they perform to make

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their lives simpler, their use has grown significantly over the past years. In the UK and throughout the world, intelligent agents are used in every industry area [1]. There are two primary sections that include the most prevalent and extensively utilized agents. The first takes place in computer-using office settings, while the second is on the Internet. Even if agents make life simpler, fewer workers are required to complete a task. A factory that manufactures cars would be one illustration of this. In the 1980s, thousands of people worked to produce automobiles. However, with the advent of machinery that uses an intelligent agent to perform repetitive tasks, many jobs were eliminated, and positions that once required four or five workers were reduced to one or two men and a machine [2]. Intelligent agents are being created on a continuous basis to do various predictable and repetitive jobs. Many different types of enterprises are using intelligent agents, whether it be in their software applications running on their computers and networks or in their machinery and equipment [3]. When the initial ideas for Intelligent Tutoring Systems (ITS) were put out in the 1980s, artificial intelligence in education began to take shape. At the moment, the field is rapidly evolving, primarily as a result of cutting-edge computer technologies like hypermedia, the Internet, and virtual reality [4]. The 90s saw the beginning of research on agent-based teaming [5]. An increasing number of researchers in the Multi-Agent System (MAS) field are interested in simulating and assisting human cooperation using intelligent agents.

Although there has been little study on multi-agent systems as a potential option for team training, we will first quickly review the ideas that have been produced as the basis for collaboration in this part. and then examine the main agent-based collaboration designs that facilitate team member coordination and communication [5-7]. In order to capture the essential elements of collaboration and system modeling of team behavior, a number of theoretical frameworks were put forth under the Belief-Desire-Intention (BDI) agency paradigm. Of these, the Joint Intentions theory and the Shared Plans theory are two well-established theories that serve as a basis for agent-based collaboration models and offer a framework for simulating team activities in a computational setting [8]. Agent-based teamwork systems prioritize the communication and teamwork of agents in achieving shared objectives.

1.1. Detailed Significance of This Study

The main objectives of teamwork include individual coordination, cooperation, and communication toward a common objective. Only members of a successful team possess the necessary individual abilities and, more crucially, the capacity to collaborate well. It has been demonstrated that, in a range of team circumstances, collaboration interventions are beneficial in improving teamwork and team performance. Because team coaching directly benefits employees and gives them the chance to improve their behaviors, deepen their knowledge, and develop their abilities, it helps business organizations achieve better results. [9]. Because of globalization and ongoing innovation, the business world is extremely competitive and concentrated today. Organizations want to use scarce resources as efficiently as possible. As a means of doing this, cooperation has demonstrated itself to be successful in human resource management for improved performance. Working as a team brings information, attitude, talent, and experience together that enable quick, adaptable, and efficient problem-solving and challenge-solving, ultimately improving performance. As a result, the efficacy of an organization's many teams has a major role in its overall success [10]. Teams that receive more attention from their organizations perform better. They also have better problem solving approach at work. One of the most crucial issues we want to solve is knowledge modeling. In comparison to other factors, cooperation significantly contributes to an organization's success in terms of increased output, better organizational performance, competitive advantage, and quantity and quality of products produced. The aim of this research is to illustrate an event-based training methodology through the creation and use of intelligent coaching agents in a team training environment. In order to teach the team the value of strong cooperation for optimal output, we want to replace the positions of human trainers with intelligent software.

This research will provide a foundation for the enhancement of organizational knowledge and skill development, enabling team members to gain the necessary abilities to carry out highly autonomous activities. The goal of the study is to improve performance in situations when successful teamwork is essential for organizational success.

1.2. Specific Objectives of This Study

The aim of this study is to develop an intelligent coaching agent for enhancing behaviors in human teamwork.

The objectives of the study include deploying a system that should be able to:

1) Create a platform to evaluate team members performance on tasks they have been given.
2) Observe team performance over time via of supervised learning.
3) Develop an intelligent feedback system based on the resource allocation model.
4) Incorporate the feedback information for better team performance.

2. Background Study and Related Works

2.1. Background of the Study

Teams allow workloads to be distributed among individuals with different levels of expertise; they allow for improved team performance; teams are characterized by a variety of

theoretical frameworks and philosophies; Up to 82% of UK businesses with 100 or more workers recently stated that they used team arrangements to increase worker productivity [11, 12]. When a group strives for synergy among its members and develops a sense of shared commitment, it becomes a team. In many different industries, the utilization of teams has resulted in significant organizational gains. The need for teamwork in many organizations is becoming more widely recognized. This is especially true for complex tasks that require high levels of mental or physical effort beyond the capabilities of an individual, as only efficient communication and multi-member collaboration can assure mission success. [13]. Since team members frequently respond to one another's words and actions as well as the demands of the environment, it is necessary to include more factors when determining how effective teams operate.

The concept of a team should take into account three key elements: interdependence, collective efforts, and individual interaction. When people work as a team, they collaborate in a positive setting to share information and abilities in order to accomplish shared objectives. A cohesive team depends on everyone working together to create an atmosphere where everyone can contribute and engage in order to foster and generate successful results. Accordingly, research has shown that it is feasible to create a system of training for staff members in any business in order to disseminate best practices and maximize outputs [14].

What truly sets a team apart from other working groups with a certain level of communication and resource sharing is the idea of a shared objective. A team's imposition of organizational structures and dependence on one another to complete activities that improve shared resources are two more distinctive characteristics. Teams who perform well have a significant competitive advantage. The whole truly is greater than the sum of its parts when a team is cohesive. Team members support one other's creativity in addition to drawing from their diverse experiences and points of view. In addition, a lot of people discover that teamwork is more fun than working alone. Teamwork is a strategy that can improve both individual and organizational performance, even if it takes steady development [14, 15]. Given the growing level of competition, organizations must consider ways to improve performance. Top managers must have the foresight to instill cooperation in their firms, the tact to foster it, and the guts to let teams participate actively in decision-making. Teams provide more difficulties, opportunities for engagement, and a sense of achievement.

Teams in organizations will draw and keep the greatest talent, which will result in a high-performing organization. Collaboration among team members, or teamwork, has been extensively studied and characterized from a variety of angles.

Over the previous several decades, there has been a significant change in the nature of labor in all spheres of human activity [15]. In order to handle the improvements in information technology, organizations today must cope with greater rivalry and collaboration from other economic sectors, which calls for the engagement of a heterogeneous workforce. The bulk of aviation accidents, medical mishaps, and industrial disasters have well-established root causes that include deficiencies in team leadership, coordination, and communication. Additionally, they have been connected to several military and political tragedies [16].

Cohesion or integration among team members is often improved through teamwork, which leads to the synchronization of efforts and great performance. According to recent research, workers who operate in teams are able to create more than those who work alone. Numerous distinct behavioral makers were also found in the various team members, according to a meta-analysis of pertinent team research [17]. People who work well together feel more empowered and capable, which is the foundation of professional happiness. It also lowers stress levels. Similarly, studies conducted by psychologists on cooperation have confirmed that teams may increase individual productivity through teamwork, making team-performing personnel the norm for organizational success.

Dividing the task into manageable chunks for everyone to contribute to is the core of collaboration. A type of fuel that enables individuals to accomplish a certain shared objective is teamwork. It is a group effort to achieve the objective of the organization. When it comes to tasks that are assigned to individuals by the organization's management, teamwork is superior to solo effort. Because there is maximum communication throughout operations, teams allow the various personnel in a company to create a welcoming environment for providing services. Teams within a business foster an atmosphere where individuals are free to speak and act upon their ideas, ultimately leading to high performance [18].

Consideration should be given to current studies on certain kinds of teams in order to grasp the idea of collaboration clearly. There have been several suggestions for grouping or categorizing teams.

2.2. Related Works

The Intelligent Tutoring System (ITS) is the first example of artificial intelligence used in education. ITS has been a crucial instrument for knowledge sharing as it uses artificial intelligence approaches to provide feedback that aids in student learning. Numerous ITS projects have been undertaken, each with a unique approach and manner of operation offered an Intelligent Tutoring System to assist learners in resolving issues that arise when using the ARD'UINO platform [19].

The system was designed and developed using the intelligent tutoring system builder authoring tool. The tool consists of four modules, much like any other ITS: the student, educational, and user interface modules. In order to facilitate the learning process and assist students acquire the C# programming language more effectively, an intelligent tutoring sys-

tem was created [20]. The system used a knowledge base with the ITSB (Intelligent Tutoring System Builder) authoring tool style to display student work and provide them with personalized comments and assistance.

Clinical medicine literature, physicians, and questionnaires were used in the design and development of a desktop-based intelligent tutoring system for diabetes education [21]. The approach made diabetes, its forms, and its diagnostics much clearer to the pupils. Additionally, it offers personalized and fast feedback. A suggested system for distant learning is the agent-based Intelligent Based Tutoring System (ABITS) [22]. The structure defined by the system is extremely reusable and appropriate for several knowledge areas.

The entity in question is a Multi Agent System, consisting of pools of three distinct agents: emotional, pedagogical, and assessment agents. Each independently completing a certain activity while collaborating to enhance learning. This system's established capabilities are efficient. A personal assistant is offered by the Intelligent Personal Assistance for Task and Time Management to help a busy worker manage their time and complete their responsibilities. It makes use of a variety of AI methods connected by a Belief-Desire-Intention (BDI)-based agent structure. The system has several automatic features and produces good results when evaluated.

A conceptual framework for simulating the everyday activities and lifestyles of individuals with Alzheimer's disease, as well as their development through various stages of the illness's improvement, was provided by the previous study [23]. It is possible to accurately estimate and forecast mistakes and behaviors in the performance of everyday tasks under certain assessment tests, as shown by simulations and preliminary findings.

The possibility of conversational frameworks to assist the conversion of current teaching systems to a natural language type of interaction was examined by Luise et al. In their study [24]. Their work drew on a pilot project in which a conversational agent interacting with a Hypergraph Based Problem Solver (HBPS) was constructed using a machine learning framework.

The conversational agent, with average weighted F1-scores of 0.965 and 0.989 for intents and entities, respectively, was able to identify the purpose of a particular user utterance and extract relevant entities connected to the message content once it had been trained adequately. Methodological instructions are presented for both generating a realistic training set needed to build the necessary Natural Language Understanding (NLU) model and assessing the system that is produced. These recommendations offer improved interaction based on natural language processing techniques, and they can be readily transferred to different ITS and situations.

It is well knowledge that many colleges have low levels of student participation and enthusiasm in online classrooms, particularly with remote education during the COVID-19 epidemic. According to Jasin et al., teachers' ability to engage with their pupils through traditional verbal and nonverbal cues is further hampered in the online setting [25]. However, it is extremely taxing for faculty to deal with such issues through synchronous communication around-the-clock. In order to assess an automated question-answering chatbot's acceptability and efficacy for assisting students enrolled in an online Chemistry course, this study describes the chatbot's training in synchronous communication and teacher immediacy tactics.

The chatbot belongs to a new generation of affective-focused chatbots that can enhance students' learning experiences by establishing a more human-like connection with them. Twelve students from a Singaporean university participated in qualitative interviews and self-report data collection as part of the chatbot's pilot research, which documented their experiences, opinions, and interactions with the chatbot. These results were then combined using thematic analysis. The outcomes validate the chatbot's proficiency in demonstrating many communication immediacy strategies and in reacting to pupils at any time of day.

Students were also able to completely concentrate and ask more questions to support their learning throughout their private session with the chatbot. Enhancements were proposed about the chatbot's word recognition and precision, along with a structure for creating communication immediacy mechanisms in subsequent chatbots. Our results bolster the possibility of using this chatbot in a comparable online environment when it has been improved. Constructing emotional, conversational agents for a chatbot learning system requires an understanding of the emotion expressed and the ability to generate suitable answers.

Three primary components make up Huang et al.'s architecture for generating emotional conversations: a sequence-to-sequence model with stacked encoders, a conditional variational autoencoder, and conditional generative adversarial networks [26].

A two-layer encoder was created for the sequence-to-sequence model with stacked encoders by fusing neural networks based on transformer and gated recurrent units. Additionally, a conditional variational autoencoder was implemented, which leverages a distribution across possible answers for learning. The findings showed that learners could generate replies that were both emotionally and linguistically acceptable. Educators have benefited greatly from the intelligent tutoring method.

A motivation evaluation model based on self-efficacy theory was presented by Thinakaran et al., in their study. According to the hypothesis, motivational factors included performance, perseverance, effort, and activity selection [27]. Additionally, each characteristic has criteria that were established for time spent, difficulty level, number of right answers, and number of questions skipped. The Mamdani inference system's benefits as a fuzzy logic approach to forecast students' motivation level were incorporated into the model's architecture. The algorithm can determine the degree of motivation of pupils much like a human tutor can in a typical

classroom.

3. System Design and Evaluation

The main menu of Agent Based Intelligent System for Teamwork Performance has four (4) sub modules: Human Relation, Team Manager, General Manager and Staff with their different sub-modules. The HR registers staff data in the database, staffs which are then grouped to form a team with specified task assigned one at a time. Note that the assignment of a new task overrides any previously assigned task. The Team Manager is the one who sets and assigns the task. The General Manager goes ahead to monitor and ascertain task execution. The monitoring agent checks the task execution. The intelligent agent scores the team performance and grade the performance. Reporting agent reports the performance to the general manager for decision making.

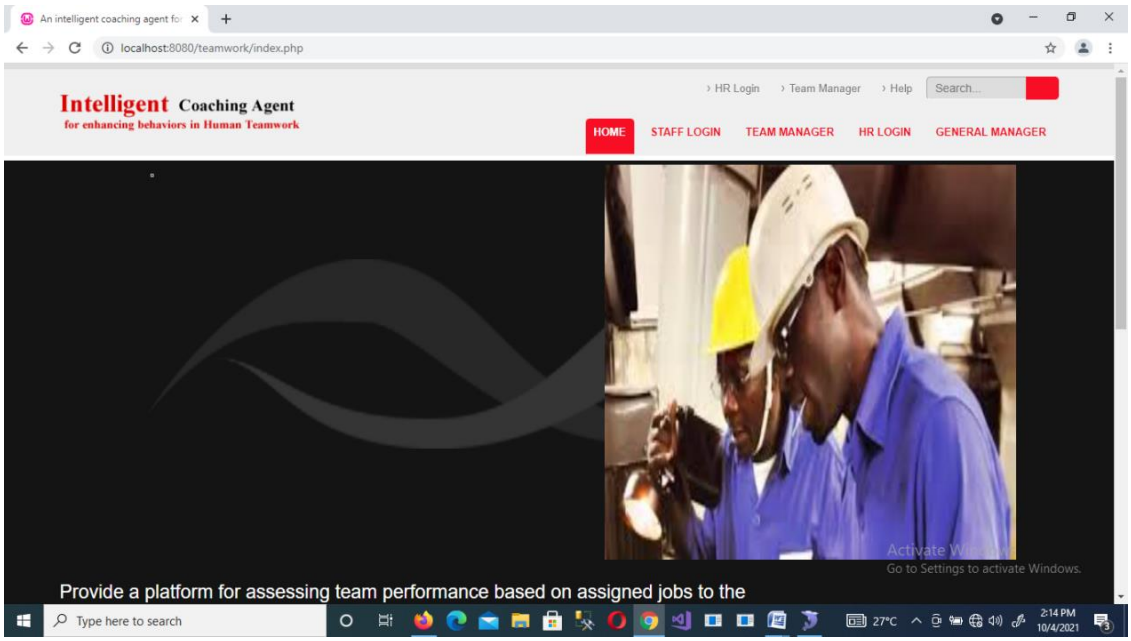

Figure 1. Home Page.

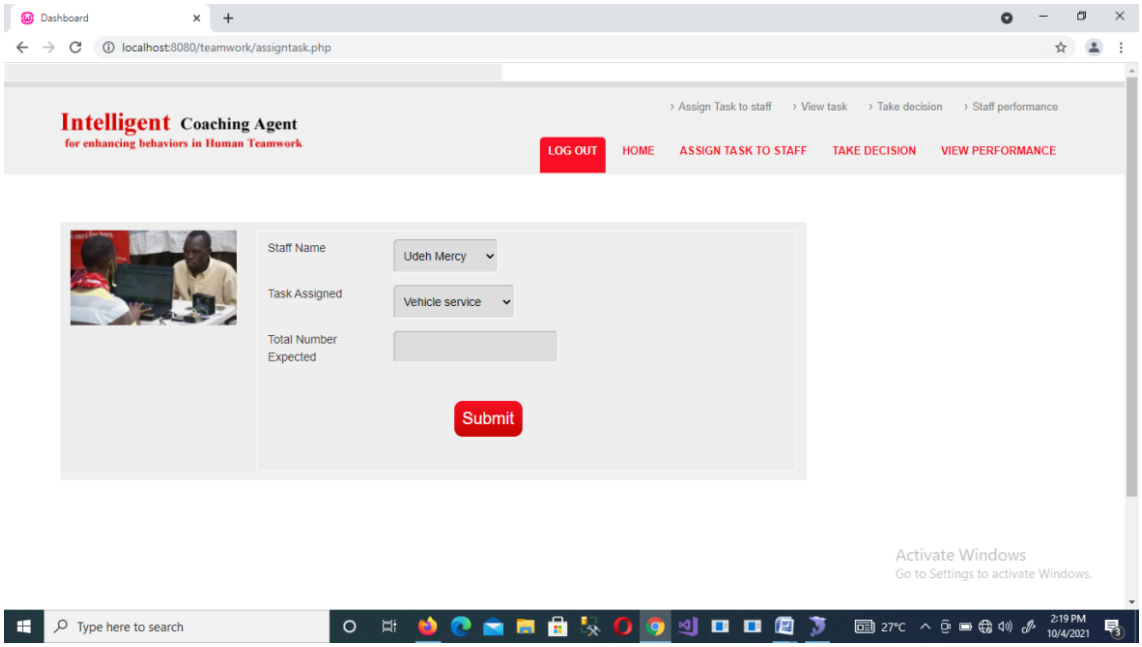

Figure 2. Assign Task to Team Form.

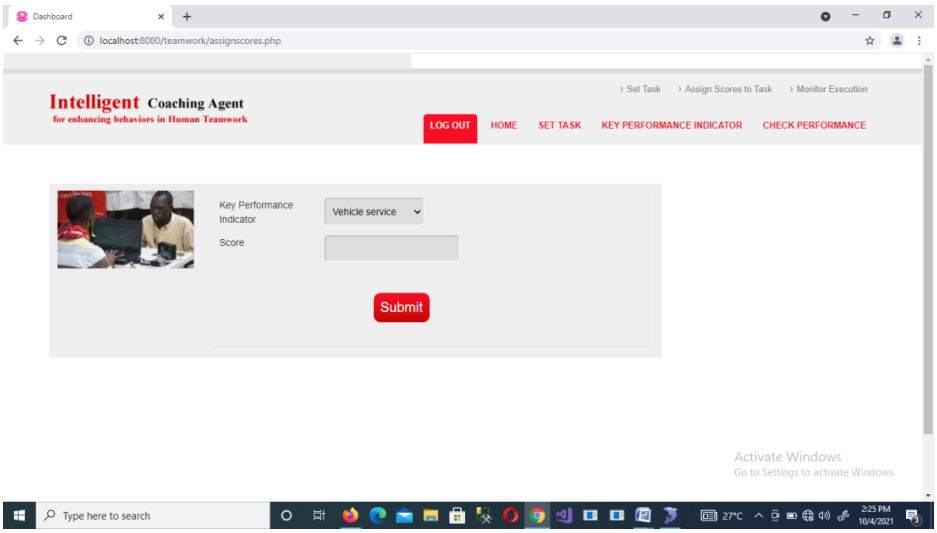

Figure 3. *Assign weight score to task Form.*

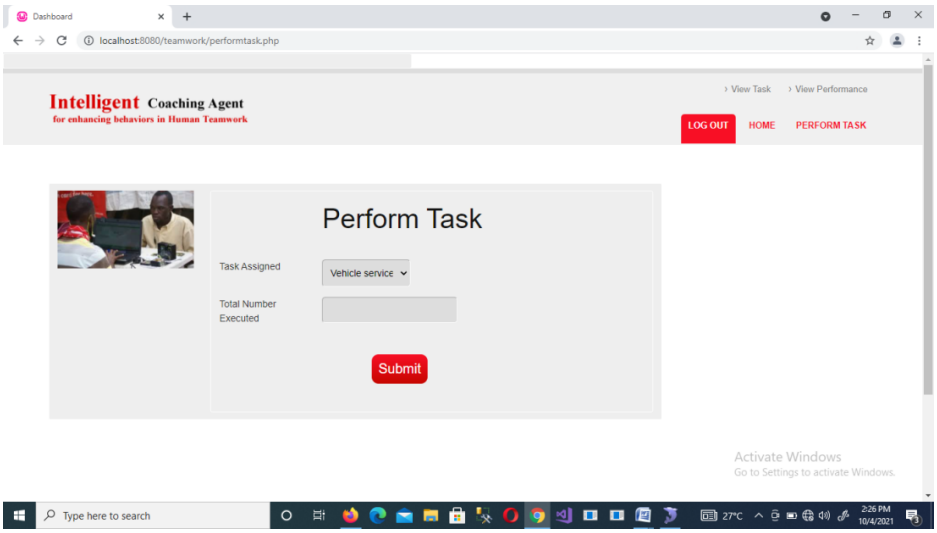

Figure 4. *Perform task Form.*

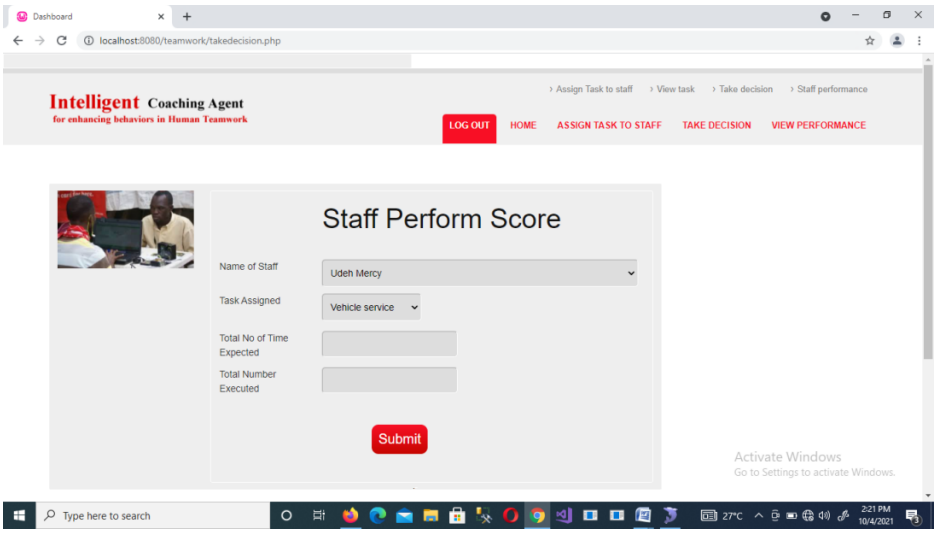

Figure 5. *Take Decision on Staff performance Form.*

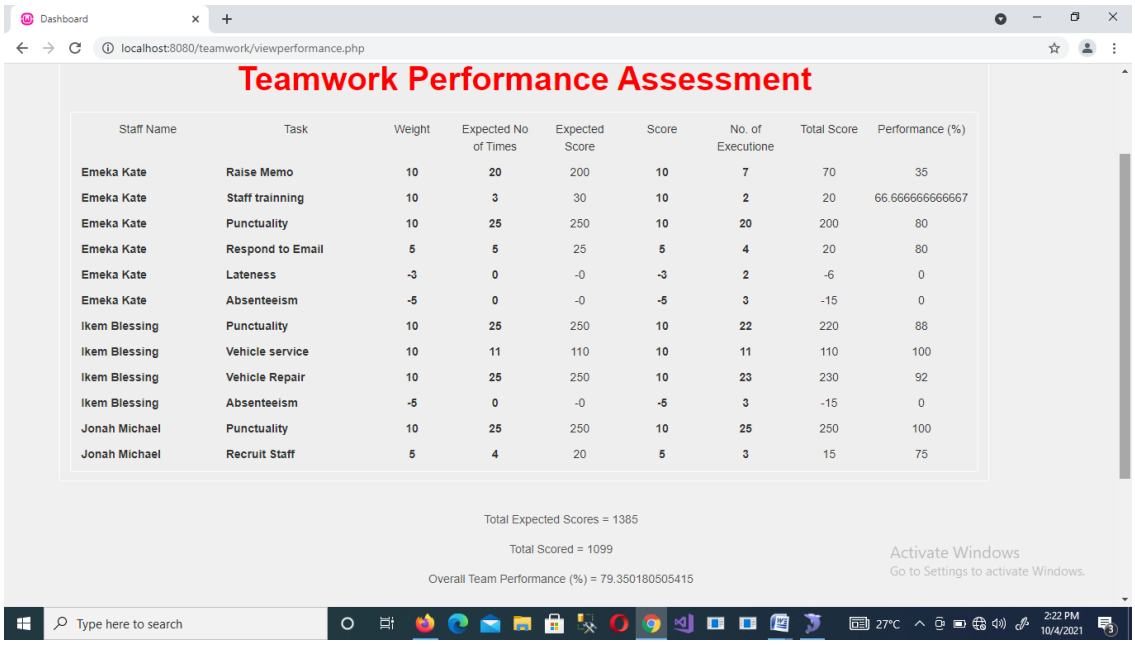

Figure 6. *View team performance form.*

4. Conclusion

This study was able to keep a closer eye on worker's performance, particularly in team setting. Performance evaluation is a methodical and ongoing procedure that aids organizations in evaluating their workforce so that the individual and group performance may be appropriately assessed. Employee performance evaluations must be done correctly as they will reveal each worker's productivity inside the company. Appropriate evaluation is also necessary for the team's job performance in order to prevent bias and achieve the necessary level of team productivity inside the company. A mechanism that would eliminate biases in employee performance reviews has been established by this research. Every task has a weighted score, so each time an employee completes a job, their performance is automatically assessed by the system.

As a result, monitoring both team and individual performance is simple. Before assigning a team score, the system uses supervised learning to keep track of how tasks are being completed and calculate the task's weight score. This approach will support individuals who deserve to remain in their positions and assist those who, as it has been made clear, need to focus on certain areas in order to grow as individuals. The output from the system, which evaluates teamwork performance, will assist the general manager in determining when to award the team or promote a staff member depending on their performance.

Conflicts of Interest

The authors declare no conflicts of interest.

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