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# Agricultural Equipment Rental System

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**ABSTRACT:** Agriculture forms the backbone of Indian economy and there is always a need of supporting and improving it .As a part of which some of Indian NGO's are with an initiative of supporting the farmers by facilitating them with the modern agricultural equipment's on rental basis .Modern agricultural equipment's make farmers work more efficient and easy .As a part of which there are some organizations that are set up to help those farmers who are in need of such equipment's ,where the organization owns the equipment's and rent those on request of farmers at liable amounts. At present, farmers need to travel to a place to borrow all the essential needs, which is a tiresome and not a cost-effective work. So, a smart digital farming is listed as the highest-ranking technology opportunity in the latest Global Opportunity report in terms of its expected positive impact on society. This paper is on digitizing the process of renting the agricultural equipment's by the farmers .We aim at developing an application that farmers can use to get their equipment's on rent and also check the availability and renting .We also allow them to book the equipment's in advance .It also helps us to get the track of equipment's that are on rent .We also aim at developing analytic for the state heads to make better availability of equipment's and to keep track of the equipment's as well, which could help in providing better support for farmers

**KEYWORDS:** Agriculture, Farmer

## I. INTRODUCTION

Agriculture forms the backbone of Indian economy and there is always a need of supporting and improving it .As a part of which some of Indian NGO's are with an initiative of supporting the farmers by facilitating them with the modern agricultural equipment's on rental basis .Modern agricultural equipment's make farmers work more efficient and easy .As a part of which there are some organizations that are set up to help those farmers who are in need of such equipment's ,where the organization owns the equipment's and rent those on request of farmers at liable amounts. At present, farmers need to travel to a place to borrow all the essential needs, which is a tiresome and not a cost-effective work. So, a smart digital farming is listed as the highest-ranking technology opportunity in the latest Global Opportunity report in terms of its expected positive impact on society. This paper is on digitizing the process of renting the agricultural equipment's by the farmers .We aim at developing an application that farmers can use to get their equipment's on rent and also check the availability and renting .We also allow them to book the equipment's in advance .It also helps us to get the track of equipment's that are on rent .We also aim at developing analytic for the state heads to make better availability of equipment's and to keep track of the equipment's as well, which could help in providing better support for farmers developing shortage of human labour. Indian farming is experiencing a progressive move from reliance on human power and creature capacity to mechanical power in light of the fact that expanding cost for upkeep of creature and developing shortage of human work. Along these lines there is a solid requirement for taking homestead automation. So, we are digitizing the agriculture equipment by the farmers.

The objectives this paper is:

- We aim at developing an application that farmers can use to get their equipment's on rent and also check the availability It reduces the cost of visiting the nodal centres to check the availability and renting.
- We also allow them to book the equipment's in advance.
- It also helps us to get the track of equipment's that are on rent
- We also aim at developing analytic for the state heads to make better availability of equipment's an to keep track of the equipment's as well which could help in providing better support for farmers

## II. RELATED WORK

Khanna, A., Rodrigues, J., Gupta, N., Swaroop, A., & Gupta, D. (2020). "Local Mutual Exclusion algorithm using fuzzy logic for Flying Ad hoc Networks." Computational Intelligence, now a days, flying ad hoc network (FANET) as a trending wireless classification has a vibrant area of research. FANET architecture can also be viewed as a special form of a distributed system in which unmanned aerial vehicles are the nodes with highly dynamic behaviour in terms of their mobility. Now, resource allocation problem is always a concern in distributed architecture, so as in FANET. The concept of mutual exclusion plays a vital role and ensures the access of shared resources in a mutual access manner by the nodes running on different processors. Through this research work, we modelled FANET as an application of a dynamic graph by applying its properties and propose a token-based resource allocation algorithm in FANET to achieve distributed mutual exclusion. We have used Neo4j as a graph database to model our work and present better results in terms of various performance metrics as compared to existing work in FANET till date.[1]

Luo, X.W., & Zhang, L.Y. (2016). "The optimal scheduling model for agricultural machinery resources with time-window constraints." International Journal of Simulation Modelling, Agricultural machinery rental is a new service form that uses big data in agriculture to improve the utilization rate of agricultural machinery and promote the development of the agricultural economy. To realize agricultural machinery scheduling optimization in cloud services, a dynamic artificial bee-colony algorithm (DABAA) is proposed to solve the above problem. First, to improve the practicability of the mathematical model in agricultural production, a dynamic coefficient is proposed. Then the mutation operation is combined with the artificial bee colony (ABC) algorithm to improve the algorithm. Then, iterative threshold adjustment and optimal fusion point evaluation are used to combine the ABC algorithm with the ant colony optimization (ACO) algorithm, which not only improves the search precision but also improves the running speed. Finally, two groups of comparison experiments are carried out, and the results show that the DABAA can obviously improve the running speed and accuracy of cloud services in agricultural machinery rental.[2]

Edwards, G., Sorensen, C.G., Buchis, D.D., & Munkholm, L.J. (2015). "Optimized schedules for sequential agricultural operations using a Tabu Search method." Computers and Electronics in Agriculture to the increasing demands of a growing world population, farmers are tasked with increasing productivity without increasing resource use. This can be achieved by deploying resources in a more efficient manner and by ensuring operations will produce maximum results. However, when contemplating the problem of scheduling multiple machines, executing multiple operations at multiple fields, it is a cumbersome task to find an optimal solution without the aid of a decision support tool. A field's readiness, in terms of its trafficability and workability, is an important factor to consider when scheduling operations. Executing operations on an unready field can lead to additional operational costs, such as drying grain harvested at an unready moisture level or removing subsoil compaction caused by machinery driving on unready soils. To ensure a schedule is actionable, the fields' readiness must be accounted for by the scheduling process, further increasing the complexity of the problem to be solved [3]

Ghori, E.J., Rahmani, A.M., & Qader, N.N. (2019). "Service load balancing, scheduling, and logistics optimization in cloud manufacturing by using a genetic algorithm." Concurrency and Computation: Practice and Experience, Recent years have seen a great deal of attention in the aspects of cloud manufacturing. Generally, in cloud manufacturing, the capabilities and manufacturing resources that distributed in different geographical places are virtualized and encapsulated into manufacturing cloud services. The literature confirms that applying queuing theory to optimize service selection and scheduling load balancing (SOSL) while taking into account logistics is still scarce and an open issue for practical implementation of cloud manufacturing. This reason motivates our attempts to present a cloud manufacturing queuing system (Experience, Recent) as well as a load balancing heuristic algorithm based on task process times (LBPT), simultaneously among the first studies in this research area. Hence, a novel optimization model as mixed-integer linear programming is developed by implementing both Experience, Recent and LBPT. Due to the natural complexity of the problem proposed, this study applies a genetic algorithm to solve the developed optimization model in large instances. Finally, the computational results ensure the effectiveness of the proposed model as well as the performance of the employed heuristic algorithm.[4]

Zhang, W., Pan, X.H., Liu, Z., Dong, T.Y., & Zhang, L. (2012). "Manufacturing service scheduling strategy based on the cloud model ant colony optimization." Computer Integrated Manufacturing Systems, Resources should be allocated efficiently in a cloud manufacturing environment, given specific cloud manufacturing task. We study on the optimal resource allocation after the qualitative analysis of the match between the tasks and the resources in this work. Along this line, many factors should be significant, including time, cost and quality of services. Moreover, the

workload of equipment's should also be considered, in order to achieve load balance and improve the efficiency of manufacturing and the productivity. Therefore, in this paper, based on a four-dimensional objective function, that is, time, cost, quality of services and the load balance, we adapt the Ant Colony Optimization (ACO) algorithm to find the optimal solution. We also present a case study to evaluate our model [5]

Al-shihabi, S.T., & AIDurgam, M.M. (2017). "A max–min ant system for the finance-based scheduling problem." Computers & Industrial Engineering, Agricultural machinery rental is a new service form that uses big data in agriculture to improve the utilization rate of agricultural machinery and promote the development of the agricultural economy. To realize agricultural machinery scheduling optimization in cloud services, a dynamic artificial bee-ant colony algorithm (DABAA) is proposed to solve the above problem. First, to improve the practicability of the mathematical model in agricultural production, a dynamic coefficient is proposed. Then the mutation operation is combined with the artificial bee colony (ABC) algorithm to improve the algorithm. Then, iterative threshold adjustment and optimal fusion point evaluation are used to combine the ABC algorithm with the ant colony optimization (ACO) algorithm, which not only improves the search precision but also improves the running speed. Finally, two groups of comparison experiments are carried out, and the results show that the DABAA can obviously improve the running speed and accuracy of cloud services in agricultural machinery rental.[6]

Li, L., Cheng, F., Cheng, X., & Pan, T. (2018). "Enterprise manufacturing logistics network optimization based on a modified multi-objective particle swarm optimization algorithm." Computer Integrated Manufacturing Systems, Process planning belongs to one of the most essential functions of the modern manufacturing system. Moreover, flexible process planning implies the ability of a system to adapt to changing requirements and thereby provide alternative ways of performing manufacturing operations on a part. Variety of manufacturing resources including variety of alternative machines, alternative tools, as well as tool access direction (TAD) leads to the fact that most of the parts in modern manufacturing systems have various flexible process plans. Therefore, obtaining optimal process plan from all available alternatives has become a very important task in the domain of flexible process planning research. In this article, a method based on modified particle swarm optimisation (mPSO) has been developed to solve this nondeterministic polynomial-hard combinatorial optimisation problem, and the following issues have been addressed: (i) the AND/OR network representation has been adopted to describe various types of flexibility, i.e. machine flexibility, tool flexibility, TAD flexibility, process flexibility and sequence flexibility; (ii) the particle encoding/decoding scheme has been proposed and traditional PSO algorithm has been modified with crossover, mutation and shift operator and (iii) optimal operation sequence has been found by performing multi-objective optimisation procedure concerning minimisation of the production time and production cost. In order to verify the performance of the proposed mPSO algorithm, five independent experiments have been carried out and comparisons with other meta-heuristic algorithms have been made. The experimental results show that the proposed algorithm has achieved satisfactory improvement in terms of efficiency and effectiveness [7]

Liu, J.W., Guo, Y., Zha, S.S., Wang, F.L., & Zhang, S.C. (2018). "Multi-station assembly sequence planning based on an improved particle swarm optimization algorithm." Computer Integrated Manufacturing Systems, aiming at the problem that the existing single station assembly sequence planning was difficult to meet the demand of the station, a multi-station assembly sequence planning method based on improved particle swarm optimization was proposed. A multi-station assembly model was created to describe the geometric information of component and its relationship to the station. The evaluation indexes such as assembly sequence feasibility, assembly direction consistency, assembly polymerizable and inter-station balance were used to construct the fitness function. Aiming at the problem that the general particle swarm algorithm was easy to fall into the local optimal solution, the inertia weight was improved, and the concept of particle similarity and similarity threshold was put forward. The mutation of the particles was controlled with similarity threshold, which improved the global search ability of the algorithm. The feasibility of the improved particle swarm optimization algorithm for multi-station assembly sequence planning was verified by a certain type of engine, and the superiority of the algorithm was proved by comparing with the genetic algorithm and the general particle swarm algorithm.[8]

Gao, W.F., & Liu, S.Y. (2012). "A modified artificial bee colony algorithm." Computers & Operations Research, Nearest neighbour (NN) is a simple machine learning algorithm, which is often used in classification problems. In this paper, a concept of modified nearest neighbour (MNN) is proposed to strengthen the optimization capability of artificial bee colony (ABC) algorithm. The new approach is called ABC based on modified nearest neighbour sequence (NNSABC). Firstly, MNN is used to construct solution sequences. Unlike the original roulette selection, NNSABC randomly chooses a solution from the corresponding nearest neighbour sequence to generate offspring.

Then, two novel search strategies based on the modified nearest neighbour sequence are employed to build a strategy pool. In the optimization process, different search strategies are dynamically chosen from the strategy pool according to the current search status. In order to study the optimization capability of NNSABC, two benchmark sets including 22 classical problems and 28 CEC 2013 complex problems are tested. Experimental results show NNSABC obtains competitive performance when compared with twenty-three other ABCs and evolutionary algorithms.[9]

Zhou, J.J., & Yao, X.F. (2017). "A hybrid artificial bee colony algorithm for the optimal selection of QoS-based cloud manufacturing service composition." *International Journal of Advanced Manufacturing Technology*, 88, 3371–3387. [Crossref] Zeng, B., Li, M.F., Zhang, Y., & Ma, J.H. (2013). "Research on assembly sequence planning based on the

Firefly Algorithm." *Journal of Mechanical Engineering*, With the advent of cloud manufacturing (CMfg), more and more services in CMfg platforms may provide the same functionality but differ in performance. In order to ensure the manufacturing cloud to match the complicated task requirements, composited CMfg service optimal selection (CCSOS) is becoming increasingly important. This study proposes a new approach for such CCSOS problems, the so-called hybrid artificial bee colony (HABC) algorithm, which employs both the probabilistic model of Archimedean copula estimation of distribution algorithm (ACEDA) and the chaos operators of global best-guided artificial bee colony to generate the offspring individuals with consideration of quality of service (QoS) and CMfg environment. Different-scale CCSOS problems are adopted to evaluate the performance of the proposed HABC. Experimental results have shown that the HABC can find better solutions compared with such algorithms as genetic algorithm, particle swarm optimization, and basic artificial bee colony algorithm [10]

### III. METHODOLOGY

#### 1. Needs Assessment:

- Conduct a comprehensive analysis of the current challenges faced by farmers in accessing modern agricultural equipment.
- Gather feedback from farmers, agricultural experts, and relevant stakeholders to understand their requirements and pain points.

#### 2. Requirement Gathering:

- Identify the essential features and functionalities required in the digital farming application through stakeholder consultations and market research.
- Prioritize features based on their importance and potential impact on improving the rental process for farmers.

#### 3. Technology Selection:

- Evaluate various technological options for developing the application, considering factors such as scalability, security, and ease of use.
- Select appropriate technologies for frontend development, backend infrastructure, database management, and analytics implementation.

#### 4. System Design:

- Create a detailed system architecture outlining the components, modules, and interactions within the application.
- Design user interfaces that are intuitive, user-friendly, and accessible for farmers with varying levels of digital literacy.

#### 5. Development:

- Implement the application according to the defined requirements and design specifications.
- Develop a centralized database to store information about available equipment, rental bookings, and ongoing transactions.
- Integrate features for equipment tracking, advanced analytics, and real-time updates on equipment availability.

#### 6. Testing:

- Conduct rigorous testing of the application to ensure functionality, performance, and security.
- Perform user acceptance testing with farmers to gather feedback and identify any usability issues or bugs.

#### 7. Deployment:

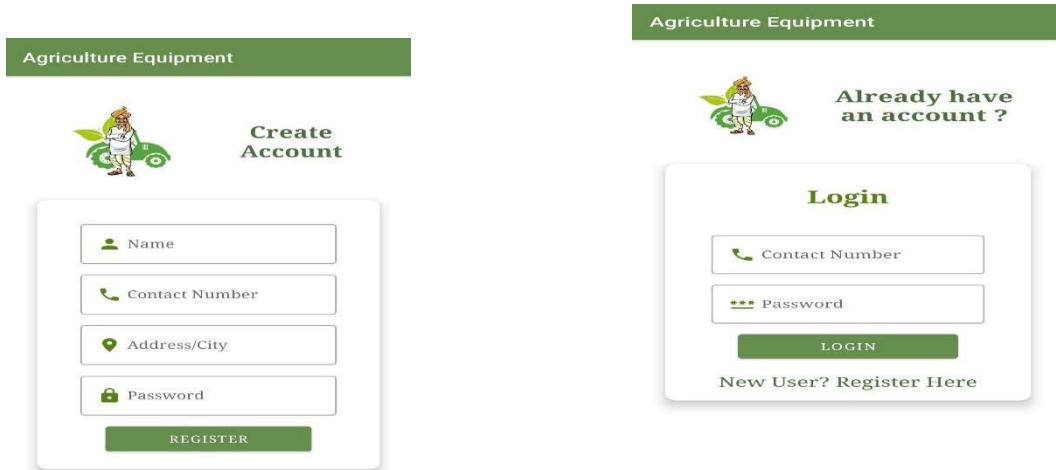
- Deploy the application on a reliable hosting platform with scalable infrastructure to handle varying levels of user traffic.
- Ensure seamless integration with existing systems and processes used by agricultural organizations and government agencies.



8. Training and Support:

- Provide training sessions for farmers and administrative staff on how to use the application effectively.
- Offer ongoing technical support and troubleshooting assistance to address any issues or concerns raised by

IV. EXPERIMENTAL RESULTS



(a) Sign up page

(b) Login page



(c) Order list page

(d) Home page



The screenshot shows a web interface titled "Agriculture Equipment". It features a "BROWSE IMAGE" button next to a placeholder box. Below this is a form with the following fields: "Equipment Name", "Equipment Price", "Equipment Quantity", and "Address/City". At the bottom of the form, there are two checkboxes: "On Rent" and "On Sell". A green "ADD EQUIPMENT" button is located at the bottom of the page.

e) Add equipment page



The screenshot shows a web interface titled "Agriculture Equipment" with a sub-header "Others Sell Equipment". It displays a product image of a yellow tractor. To the right of the image, the following details are listed: "Name : chair", "Quantity : 99", and "Price : 100". A green "ORDER" button is positioned below the details.

(f) Sell page

## V. CONCLUSION

The online administration framework for Agri-Equipment rental framework was made to guarantee the productive task and straightforward administration of a government-upheld farming hardware rental business. It reduces the manual work. It reduces the paper work, thus supporting the sustainable environment. It saves time also. Moreover, the proper documentation of whole project is also provided so that any-one can understand the project and can do the necessary changes if required. This application can be improved in many ways and can be extended to support multiple devices. Following are some of the possible extensions: Analytics can be extended in such a way that State head can view, in which region which machinery is required and move to that location in prior. Inclusion of crops and fertilizers to the list. Inclusion of GPS and maps which can help in identifying the current locomotion state of it.

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