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# Automated Task Allotment in Unmanned Submarines by Smart Searching Algorithm

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***Abstract*--In the vicinity of multi agent device agreement internet protocol is widely used for the status quo of conversation among sellers. In my research I recognition at the running method of CNP. There are distinct areas like genetic algorithm, multi robotic challenge allocation, reservoir flood manage gadget, structural health tracking, underwater unmanned car system in which CNP works. Although, various algorithms are proposed to improve the performance of CNP and they are actual powerful but there's some region which is untouched for a while. In CNP, there are three tiers of venture allocations. Decrease the failure rate of CNP is the cause of this studies, in doing so ACO is use in biding level. For showing our research we use the prototype of UUV Swarm machine.**

***Keywords: ACO, CNP, ICNP, UUV Agents.***

## 1. Introduction:

In today's world technology is work as a base plateform for every organization. In field of artificial intelligence, Agent based technology gives the best and appropriate results. These agents are alike of computer program. Multiple agents are accomplished under one organization is known as multi agent system. These MAS technology working on large scale in many field like medical organization, education system, gaming zone, space technology, security system, army, navy (UUV swarm system), airforce system, traffic signal problem, etc

There are many technologies exist in the field of multi agent system; which improves the working of MAS in different parameter. MAS exist in area of computer intelligence from more than three decades. Intelligence is basically ability to reason, learn, act and react. The era of artificial intelligence work as the base for the invention of Multi Agent System. MAS developed to solve to complex problems which could not be solved by using single agent. Agent is nothing but a small computer program or robot which detect the problems and solve them by using its intelligence. MAS is nothing other then group of autonomous agents which are working in group in order to achieve final goal. In many MAS output of one agent is input of another agent. The member agent of Multi Agent System should be autonomous as well as collaborative to accomplish the complex task for which multi agent system designed specifically.MAS is designed because a single agent is not able to solve the complex or large problem because it has not sufficient resources and knowledge about that problem. [1]

Unmanned Under water Vehicles (UUVs) have gained popularity for the last decades, especially for the purpose of not risking human life in dangerous operations. On the other hand, under water environment introduces numerous challenges in navigation, control and communication of such vehicles. Certainly, this fact makes the development of these vehicles more interesting and engineering-wise more attractive. Studies on Unmanned Underwater Vehicles (UUVs) have shown a dramatic increase specially in the last two three decades. Many examples of Remotely Operated Vehicles (ROVs), Autonomous Underwater Vehicles (AUVs) and Single –Shot ROVs (SSRs)were developed and used successfully on various applications; such as oceanographic surveys, bathymetric measurements, under water maintenance activities (e.g. those performed at oil platforms, fiber optic communicate online, etc.) and certainly military defence. Existing vehicles are how in continuous progress in term soft technology, advanced navigation and control functionalities, longer missions, flexibility and high capacity of pay loading addition to a very diverse suite of sensors. With the increasing scientific and technological development of Unmanned Underwater Vehicle (UUV) swarm system in science and engineering fields[2–4], and because of complex under water mission and dynamic environment[3,5],task optimal allocation has been attracted some attention. Multi-Agent system (MAS) is consisted of agents to realize the collaborative operation, those agents have a certain intelligent to independently think and reason under complex environment [6–9]. Therefore, the MAS theory and technology can solve UUV swarm system related task optimal allocation because of its cooperative problem solving ability. In order to realize the collaboration, the design of communication interaction algorithm or protocol is very important.

## 2. Related Work:

The key to utilizing the potential of multirobot systems is cooperation. How can **[1] T. Fukuda,** achieved cooperation in systems composed of failure-prone autonomous robots operating in noisy dynamic environments? In this work, we present a novel method of dynamic task allocation for groups of such robots. **[1] T. Fukuda,** implemented and tested an auction-based task allocation system which we call MURDOCH, built upon a principled, resource centric, publish subscribe communication model. A variant of the Contract Net Protocol, MURDOCH produces a distributed approximation to a global optimum of resource usage. We validated MURDOCH in two very different domains: a tightly coupled multirobot physical manipulation task and a loosely coupled multirobot experiment in long-term autonomy. The primary contribution of this work is to show empirically that distributed negotiation mechanisms such as MURDOCH are viable and effective for coordinating physical multirobot systems.

**[2] L. Monostori,** focused on interaction protocols and topologies of multiagent systems (MASs) for task allocation, particularly in manufacturing application. Resource agents in manufacturing are members of a network whose possible logicaltopologies and governing interaction protocol influence the scheduling and control in the MAS. Four models are presented in this work, each having specific rules and characteristics for scheduling and task allocation. Two models out of the four use a well-known standard interaction method [contract-net protocol (CNP)], while the others are proposed in this work. The newly proposed models are based on ring topology and algorithms developed in the research. A Java-based MAS was also developed simulate different scenarios of task allocation and to compare the four models in terms of some scheduling performance indicators, using cases from manufacturing. The results produced meaningful differences between the four models, including their strengths and weaknesses. Two models, namely, modified ring and CNP-based peer-to-peer, gave superior performance compared with the others. Furthermore, the proposed modified ring exhibits significant potential in handling manufacturing task allocation applications.

**[3] Leaver, R. Greg,** developed MV3204 to teach new students how to author 3D graphics for the Web. This course receives strong and increasingly enthusiastic support from computer-graphics students as well as students in a variety of other NPS curricula. It is an allowed alternative for MV4202, INTRODUCTION TO 3D GRAPHICS. Further innovations continue. Through my efforts with the Extensible 3D (X3D) Graphics specification and together with staff support, I have developed the software for a new authoring tool (X3D-Edit) that has significantly enhanced student productivity. This work directly builds on prior VRML efforts since X3D is an alternate encoding of VRML using the Extensible Markup Language (XML). From the course description:

**[4] Bailey,** introduced a physics-based and control-oriented underwater vehicle model for near-surface operations. To construct the model, we follow an energy-based Lagrangian approach, where the presence of the free surface is incorporated using a free surface Lagrangian. This effectively modifies the system energy commonly used to derive the Kirchho equations, which govern underwater vehicle motion in an unbounded ideal uid. The system Lagrangian is then used to derive the 6-DOF equations of motion for an underwater vehicle maneuvering near the free surface in otherwise calm seas. To illustrate the additional capabilities of the proposed model, they present an analytical hydrodynamic solution for a circular cylinder traveling parallel to the free surface. Comparisons are also drawn between the proposed model and the Cummins model (Cummins, 1962). While Cummins' model exactly satisfies the free surface boundary condition and approximately satisfies the body boundary condition, we choose to exactly satisfy the body boundary condition and approximately satisfy the free surface condition. This exchange removes the restriction that limits the Cummins equations to slow-maneuvering in a seaway.

**[5] Arshad** presented an analytical framework to model calm-water underwater vehicle maneuvering in the presence of a free surface, constructed from first principles. Using the free surface Lagrangian, the system energy Lamb used in deriving the Kirchof's equations (Lamb, 1932) was modified to incorporate free surface effects. The system Lagrangian was ultimately used to derive the 6-DOF equations of motion using a modified form of the Euler-Lagrange equations. Some of the capabilities of the equations were explored through the simple case of a 2-D circular cylinder.

## 3. Methodology:

Collective natural bio-systems like ant and bee colonies, flocks of birds and swarms, as well as systems of cells and molecules are composed of multi- ple bio-entities residing in the physical environment and engaged in complex collective and organized behaviors, interactions and processes according to the laws of nature. There is a certain level of abstraction at which behav- ior of such systems can be modeled as distributed computational processes resulted from the interaction of artificial computational entities. Thus, we would expect distributed computing to have a lot of potential for the practical application of nature-inspired computing – i.e. computing inspired by behaviors of natural bio-systems.[3]

Most of the works related to distributed ACO do not provide an intuitive and straight- forward mapping of ACO algorithms onto distributed computing systems. Rather, existing approaches rely on adapting the classical sequential algo- rithms for parallel and high-performance computing architectures without a careful and in-depth consideration of the intrinsic distributed nature of ACO. In this context, we support the idea that ACO should allow a more straightforward mapping onto existing distributed architectures, including multi-agent systems middleware. Therefore, to take advantage of the full po- tential of nature inspired computational approaches, we have started the in- vestigation of new distributed forms of ACO using state-of-the-art multiagent technology. The focus of our research is to propose a better computational architecture and programming for the implementation of ACO algorithms utilizing available state-of-the-art distributed multi-agent middleware. We foresee two potential benefits of our work: (i) first, it contributes to the engi- neering of ACO algorithms using distributed computing architectures, with the potential of

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obtaining more scalable and efficient algorithms; (ii) second, as a byproduct, our work contributes to better understanding of new forms of agent-based distributed ACO.

In particular, Ant Colony Optimization (ACO hereafter) [1] is inspired by collective behavior of colonies of natural ants when they explore the environment searching for food. During their search process, ants secrete pheromone on their way back to their anthill. Other ants of the colony sense the pheromone and are attracted to the marked paths; the more pheromone is deposited on a path, the more attractive that path becomes. The pheromone is volatile and disappears over time. Evaporation erases pheromone on longer paths as well as on less interesting paths. Shorter paths are refreshed more quickly, thus having the chance of being more frequently explored. Intu- itively, ants will converge towards the most efficient path due to the fact that it gets the strongest concentration of pheromone.

According to Sorin Ilie and Costin B˘adica the configurable distributed architecture called ACODA that provides a novel and more intuitive way of distributing ant-based nature inspired computational processes onto state-of-the-art multi-agent middleware. Moreover, we realized an initial experimental evaluation of this architecture by applying it to solve the TSP problem. The main innovations introduced by our approach are:

(i) The physical environment of the ants is conceptualized, represented and implemented as a distributed multi-agent system.

(ii) Ant management that is responsible with ant migration in the physical environment is represented as messages exchanged asynchronously between the agents of the problem environment.

MAS theory as the powerful and effective tool for modelling is employed and referred according to the problems that is from UUV formation system. Therefore, corresponding relations between UUV formation system and MAS are established and shown in Fig. 1. As shown in Fig. 1, Part A focuses on the UUV-Agent modelling, which can be solved by the Agent architecture modelling and reactive behavior modelling; Part B focuses on the Multi-Agent collaborative modeling of UUV formation system, which can be solved by topology structure and collaborative strategy of MAS.[4]

## Static Structure

The UUV model shown as in Fig. 2 mainly includes four parts: Sensor, Communicator, Decision controller, and Actuator. To adapt to a variety of tasks in the complex under water environment, the sensor system can detect the underwater target and obtain the movement element, which mainly contains the Forward Looking Sonar, Side Looking Sonar, and Acoustic Doppler Current profile. The communicator system can interact with other UUV or communication equipments; The Decision Controller system can control the motion of UUV by the specific knowledge. Actuator system can execute the motion rules by propeller, horizontal and vertical rudder. Therefore, the four parts work together to accomplish the UUV underwater movement.

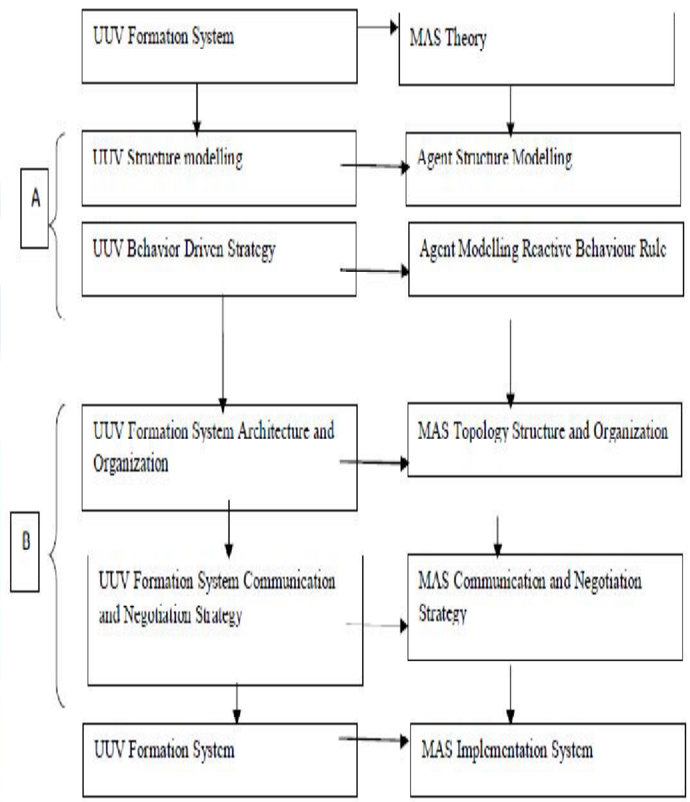


**Fig. 1: Corresponding Relationship**

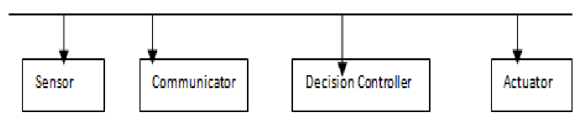


**Fig. 2. UUV Agent Model**

## Hybrid UUV-Agent model

According to UUV structure and Agent architecture, the hybrid UUV- Agent architecture model is established, which absorbs quick response of Reactive Agent Architecture Model (RAAM) and possesses advantages of reasoning of Deliberative Agent Architecture Model (DAAM). Hybrid UUV-Agent architecture model contains reactor, sensor, communicator, and decision controller,

The reactor, sensor, and communicator are the only interfaces between UUV- Agent and the marine environment. Decision controller consists of actuator, coordination controller, learning system and knowledge base system. The detailed working principle of decision controller is analyzed as follows. Coordination controller is responsible for running of information flow. When the sensor detects the change in the environment state, it is used for interpretation and classification of information, and to assign the information to the relevant work units.

(1) If the perceived information is a simple condition, it is sent to the reactor directly.

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(2) If the perceived information is a complicated condition, it is sent to the planner for reasoning and learning.

Agent knowledge base system and Agent learning system comprise learning, reasoning and decision.

(1) Agent knowledge base system is the outstanding performance of intelligent feature of UUV-Agent. Agent knowledge base system is a reflection of DAAM, which mainly executes the reasoning process under the complicated or time affluence condition. It can be constituted of two parts, Knowledge-Base includes different kinds of algorithms and models that can be used for fusion, location, tracking and recognition underwater target. Planner and Decider are responsible for the establishment of the short-term action plan and produces the real- time action sequences.

(2) Agent learning system is the other important intelligent feature of UUV-Agent, which executes the learning process. When feedback information that comes from the coordination controller is the new underwater target or environment, the information is processed and analyzed to form the Knowledge or update Rule Base through information processing and performance evaluation module.
Reactor is a reflection of RAAM, which mainly executes the reactive process under a simple or an emergency condition

**4. Result and Discussion:**
To examine my research, the 7 loops of 30 iterations is implemented. In every loop the wide variety of duties is increasing like two hundred, four hundred, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000. In every loop the failure fee at various nodes is decreasing in superb way. Nodes at which the failure rate is calculate are 30,60,a hundred and twenty, 240,480,960,1920. At the node 30,60, and a hundred and twenty the failure rate is comparable as ICNP [1] however at the node 240,480,960,1920 is failure fee is decreasing in comparison to ICNP[1] the table beneath defined the distinction in ACO based CNP and ICNP.

**Table 1: failure rate at different nodes**

| Nodes | ICNP | ACO Based CNP |
|---|---|---|
| 30 | 0 | 0 |
| 60 | 0 | 0 |
| 120 | 0.01 | 0.01 |
| 240 | 0.03 | 0.01 |
| 480 | 0.07 | 0.03 |
| 960 | 0.13 | 0.08 |
| 1920 | 0.23 | 0.10 |
| Avg. Value | 0.68 | 0.033 |

As shown in fig. 3 , the graphical representation of the failure rate at different nodes compared with the ICNP and when the task number is increasing the new version of CNP with ACO works well.

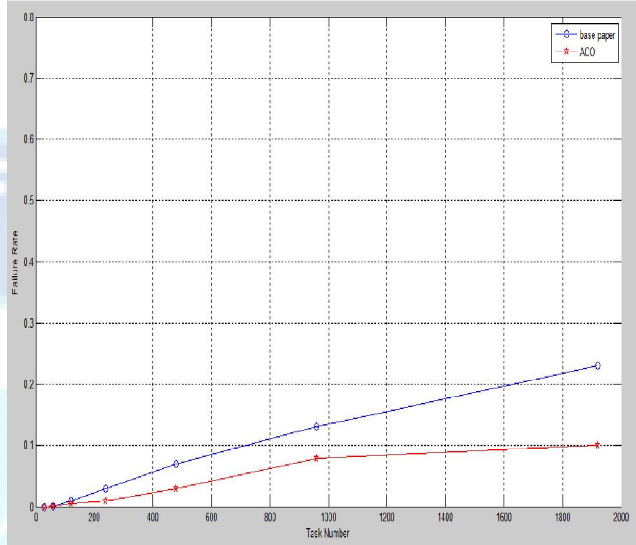


**Fig 3: Graphical Representation**

**5. Conclusion:**
This research paper suggests the mission allocation manner in underwater automobile system is a extensive location for research. UUV gadget brings the drastic adjustments in lots of fields like marine hydrology, underwater warfare, oceanography, seafloor survey, and existence underwater survey. CNP installed the verbal exchange in UUV gadget. Tasks are allocated by one-of-a-kind technique but every technique shows distinct results. Some technique decrees the execution time, some methodology increases the accuracy. In my research the failure price is took as a parameter to reveal the outcomes as shown in fig 3. After calculating the pleasant bid the mission is provided. In table 1 it shows that the failure charge if ICNP (zero.068) is extra than the failure rate of ACO BASED CNP (0.033).

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