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Robotization in Petroleum Industry

Shubham B. Kumbhar[1], Dhanashri B. Kumbhar[2]
[1]*Department of Technology, Shivaji University, Kolhapur*

Abstract: ***Robotics in petroleum industry is extremely interesting research field that pose intimidating challenges in both theoretical and practical way. Using the same old conventional methods for various operations in the petroleum industry are more difficult and challenging. Petroleum industry facing many core problems right now, substantial research work is needed in those areas. Robotization in the petroleum industry can help in accomplishing a number of important tasks with great efficiency and safety, provided they do not affect the employment opportunities in the industry which are already lacking in several parts around of the world. Though robots can perform and help in many crucial jobs, it would be extremely difficult for them to replace the experience, knowledge, and skills which petroleum industry workers bring along with them to the industry. A healthy balance between robotization and workers efforts is the key to enhancing the quality and safety of work for the benefit of the whole industry. The launch of an international robotics competition called the ARGOS (Autonomous Robot for Gas and Oil Sites) challenge would be very motivating for the engineers to work on these problems and finding the satisfying technical solutions. The association of the robotics with the petroleum industry would be solution for the various problems which are encountered in the petroleum industry. Furthermore, this paper reviews the current robotics and automation availability in the industry. The challenges faced as well as requirements of robotics and automation in the petroleum industry are presented. Possible future research scope is also discussed.***

Keywords: ***Robotics, Oil and Gas, ARGOS, Automation, Petroleum Industry.***

I. INTRODUCTION

This Robotic technology is used more and more these days, to say the least. A report by International Data Corporation said the worldwide robotics market will be worth $135.4 billion in 2019-20. In nearly every industry, robots are used for improving productivity as well as reducing operation costs. The petroleum industry is no different. Despite their size and potential investment capital, the petroleum industry hasn't previously been a huge adopter of robotics and automation. For efficiency and maximum production and the capabilities required to further exploration is to implement robotics and automation in offshore oil & gas environments. The advanced robotics for the various purpose is required, while designing the robots for offshore the other aspects also must be considered such as harsh environment, availability of components and other challenges related to particular area. The petroleum industry is growing so is robotics industry the coalition of these will achieve great future. So more research is needed to be done.

II. CHALLENGES

A. Mobility and navigation

Land, undersea or outer space vehicle, there are variety of challenges. The robot will have to be better able to know where it is and make decisions on which way to go to fulfill its assigned task. The methods currently being used must be improved for greater versatility and sturdiness.

B. Atmosphere

atmospheric conditions in petroleum industry are quite harsh. Due to the substances used and generated during the processing of hydro carbon resources, explosive, toxic and corrosive gases occurred during processing.

C. Availability of components

As for any new field, robotic scientists are developing many components on spec. So that robots may become more accessible, some components will become standard and will be mass-produced at low cost. According to applications in the industries.

D. Investing in Innovation and R&D

Every company understands nowadays, that R&D and Innovation is a key to growth and prosperity. This position creates severe competition between market-players with sufficient resources for R&D.

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E. Unsheltered maritime environment

Except for the living quarters and a few technical rooms offshore platforms are partially sheltered and unsheltered. This means there is no sufficient protection against saltwater spray and direct sun light which is also reflected from the sea surface.

F. Temperature conditions

The temperature must be healthy for the robot to work flawlessly. The heavy changes in the temperature affects the working.Page Style

III. REQUIREMENTS

A. Robotic system

Complex Environment, Corrosive Environments- Sea Waters (Salty), Humidity.

B. Software Development

Autonomous Robots, Easily Programmable, Safely Interaction with robot of workers.

C. Hardware Development

Use Of Sensors, Use f manipulator, harsh environment suitability, Maneuvering in confined spaces

D. Communication

The industries are located at remote places so it's so hard for teleoperation for such unmanned facilities.

IV. CURRENT ROBOTIC TECHNOLOGIES

A. The Remotely Operated Underwater Vehicles (Rovs)

ROV- Remotely operated underwater Vehicles consist of cable cord connection the information is transmitted from the remote controller and received at the other end at ROV. The electrical power requirement is full filled by cable used. ROV's are capable of doing many things such as picking the object, putting it to other places. ROVs available in different sizes such as from small vehicles with TVs mounted on it for very simple observation up to complex working systems, which can have several deft manipulators, TV's, video cameras, various tools and other equipment. Small inspection only ROV's can be as small as a ball whilst some of the heavier work class Vehicles are as large as a small car, truck. Some of the ROV's are so heavy that they size and shape same as bulldozer up to 18tons. The deployment of ROV's are easy vehicles of small and large sizes are deployed quickly they will work as long as they have AC power. Single person can easily control the ROV we don't need heavy man power. The in under waters is limited by operator endurance the – Controlling a ROV requires concentration. It requires minimal power consumption.

B. Mobile Robot Platforms

Many mobile robots for industrial applications and outdoor use have been developed in the last decades but only a few of them have managed to establish themselves in commercial applications. In most cases such applications are focused on a very specific problem. Typical examples are: subsea work, decommissioning in nuclear power plants, tele-operated demolition cleaning, and space

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exploration. The use of mobile robots in these cases comes into hand due to the fact that the environments in these application is unfriendly or even dangerous for humans and it is more safe to let a robot perform the work.

C. SUBSEA ROBOTS

Majority of the oil and gas formation reserves lay underneath the ocean's floor and getting to them presents engineering challenges. The problems may include, the human safety risks, weather and ice related issues and environmental insecurities etc. autonomously controlled robot, the unmanned drilling rig at the bottom of sea will resolve the problems and challenges related such as harsh environment, darkness, floating iceberg etc. Instead of building an offshore surface platform to drill for oil and gas at the seabed, up to 3000 meters below, exploration companies can use the Seabed Rig system for drilling on sea floor using robotically operated systems.by using only support vessel at the surface. These are the other robotics systems can be used in the sea bed applications: Automated Seabed Inspection System. Automated Seabed Maintenance and Repair System.

D. Surface Robotics

Surface robotics research and development (R&D) in the O&G industry has led to the design of two main design prototypes that exist today:

E. MIMROex

Inspection and maintenance tasks on offshore platforms as well as in chemical and petrochemical production facilities offer great potential for automation. However, due to the high complexity of installation as well as the requirement of additional maintenance this monotonous, sometimes dangerous work can only occasionally be carried out using conventional decentralized automation solutions. The use of a mobile inspection robot allows these problems to be overcome as well as to achieve lower operating costs and improved occupational health and safety. Especially the following maintenance and inspection tasks offer high potential for mobile robot operation:

1) Monitoring of liquid levels and readings of gauges
2) Acoustic inspection, e.g. of pumps
3) Checking for leaks

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4) Taking of samples
5) Maintenance of stationary fire and gas sensors.

F. SENSABOT

Developed by the National Robotics Engineering Center (NREC), a spin off from the Carnegie Mellon University in America, the robot is designed for inspection purposes using an assisted tele-operation control mode via a wireless link and joystick human machine interface. The system uses a laser scanner for collision avoidance and benefits from a cog rail complementary structure designed to allow the robot to move between different levels on a multi floor production facility. The robot is designed to International Electro technical Commission System for Certification to Standards in Relating to Equipment for use in Explosive Atmospheres (IECEx). With a sensor payload containing inspection camera, thermal, vibration and toxic gas instrumentation.

V. FUTURE RESEARCH OPPORTUNITIES

Currently, no existing autonomous surface robot is able to meet the specific needs of hydrocarbon exploration and production activities.

UAV's can be developed for particular applications in the industry. Currently, pipe handling robots and ROV arms are two types of manipulators used in oil and gas. As people are looking for more automated oil rigs, specialized robot arms should be developed. The robot arms should be able to tolerate the harsh environments in the oil and gas areas.

Teleportation will still be the enabling technology in a short term because the oil & gas industry hesitates about using fully automated robotic system on the oil and gas operations. Different teleoperation technologies should be developed for different applications.

Instead of building an offshore surface platform to drill for oil and gas at the seabed, up to 3000 meters below, exploration companies can use the Seabed Rig system to drill on the sea floor using robotic systems, with only a support vessel at the surface.

Hard Automation, oil and gas industry does not require highly flexible systems, hard automation could be better solutions for the industry.

ROV's ROVs without using long cables from a vessel.

Vehicle able to do automated intervention tasks by itself.

Operations are controlled from shore based on generic commands, and vehicle sends feedback trough the production systems power and communication lines.

VI. CONCLUSIONS

Robotics is developing field robotics has been practiced in every stream, petroleum industry is no exception to it but there is need to develop various machines according to particular problems faced in the industries. The current petroleum industry scenario indicates that the petroleum industry is rapidly adopting changes related to robotics and automation. The various robots are developed which

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are used in the upstream, downstream operations the leading petroleum companies are investing more and more on the robotization. As it is newly practiced in the industry various changes and inventions needed to be done. ARGOS motivating scientists and robotics amateurs to invent such robots and contribute to the field of the robotics as well as Oil and Gas. In this paper introduction to the some of the current technologies are performed, as well as the future scope for research in this field are discussed.

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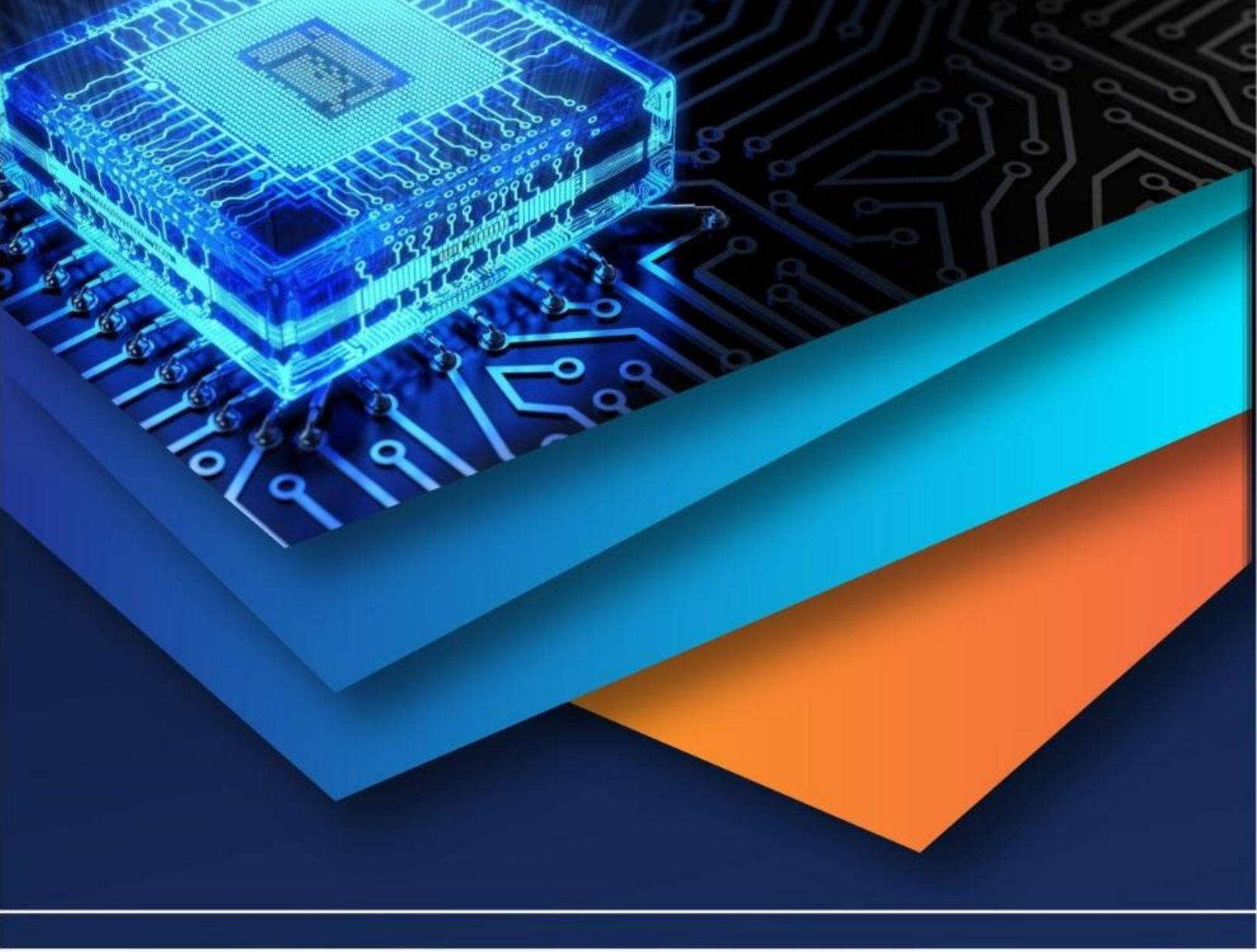

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