Review on Design and Analysis of Robot

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Abstract— Robots are becoming essential for automation in every sector i.e. automobile, industrial and bio-medical. The objective of current research is to review the existing researches conducted in the field of robot design and development. The existing researches are based on fabrication of robots, numerical and experimental analysis of robotic components. The application of robot in recent COVID 19 pandemic is also presented. The incorporation of new artificial intelligence based techniques on improving the functionality and decision making of robots is also presented by various researchers.

Keywords: Robots, Design, Material

I. Introduction

In automobile industries, construction and many different manufacturing sectors, different types of robots are used having many human beings like functioning. These robots have a robotic arm that is different in shape, size, and function according to our needs. These robotics arms are very often like a human arm and operate in a different production piece of function. A robot is a structure that includes sensors, control systems, manipulators, power supplies and software's all working jointly to accomplish a work. Designing, building, programming and doing analysis of a robot is a combination of physics, engineering, mathematics, and computing. It's anthropomorphic or human-like functioning embraces few sensory pieces of equipment that are used to the interface and connect the device with the other part of devices to take effortless or essential judgment to run adequately.

II. Literature review

In literature [1] described to improve human machine communication between the Leap Motion controller and the 6-DOF Jaco robot arm. The algorithm was developed to allow for better mapping between user hand movements, followed by Leap Motion control. The system should allow for more natural human computer interaction and the deception of the robot arm. The use of this interactive human robot has been discussed in relation to Ambient Assisted Living, where other operating conditions have been introduced.

To create a robotic arm that controls the natural movement of the human arm whose data is obtained using accelerometers [2] is proposed. The upgrade of this arm was based on the ATmega32 and AT mega 640 platform as well as the personal computer processing signal. Finally, this arm model may be expected to overcome a problem such as placing or picking up dangerous objects or non-hazardous objects that were away from the user.

In literature [3] the construction and development of a microcontroller (AT mega) robot arm is described. The robot arm responds to touch and can be programmed to move in a straight line with the function. The system detects the movement of the user's arm and the robot arm repeats the touch input provided. Touch feels the number of potentiometers embedded in the glove. Movement in the potentiometer controls the position of servo motors that drive parts of the arm.

In the literature [4] he introduced a new improved natural interaction for remote control of the robot arm. The interface is built using nertial moving trackers. Two types of moving tracks are used. The first tracker is the Xsens Xbus Kit tracker and the second is the Razer Hydra Controller. The Hydra controller is used to determine the design of the robot arm in a 3D environment. One of the most difficult problems solved in a comprehensive and represented manner in this article is to process acceleration data to measure the precise location of a robotic arm sufficient for the user's movement. Algorithms' parameters results determine the values and results of the physical interface test.

In literature [5] proposed an accelerometer-based system to control an industrial robot. These accelerometers are attached to the human arms, recording their behavior (gestures and posture). An Artificial Neural Network (ANN) trained with the back transmission algorithm was used to detect arm movements and posture. The robot begins to move at about the same time as the user begins to make a touch or stop (low response time). The results show that the system provides industrial robot control in an intuitive way. Acquired sensitivity and touch level (92%).

In literature [6], Gourab Sen Gupta, S. C. Mukhopadhyay and Matthew Finnie (2009) have proposed the design of anthropomorphic arm arm control over LAN or online. The user can control the robot's arm remotely and access its sensory response signals. A robotic arm camera captures images and transmits them to the control station. The robot arm is controlled using a slave control system.

In literature [7], Sulabh Kumra, Rajat Saxena and Shilpa Mehta described the design and development of low-cost and easy-to-use visual-control anthropomorphic 6-DOF robot arm. The robot arm's specification is achieved by about six members of a single rotating axis. The Tele-operator, champion, uses the Man Machine Interface (MMI) to operate a real-time robotic arm. MMI has simple motion capture devices that translate movement into analog electric power that brings the corresponding active signals to the arm of the robot.

In [8], Hye-Jong Kim, Yuto Tanaka, Akihiro Kawamura, Sadao Kawamura and Yasutaka Nishioka (2015) introduced a rotating robot-controlled robot arm for use in health care applications. The arm is made almost entirely of plastic material: breathable connectors, air bag actuators, and acrylonitrile butadiene styrene (ABS) joints. It is softer and lighter than conventional robot arms made of steel and heavy materials. A new control mode is proposed to be controlled with the play stick. Here's a four-degree flexible robot arm (4 DOF) to test the results of a robotic arm arm control.

In literature [9], S.P. Praturu and J.N. Anderson proposed a signal-to-signal interface (PSI), which provides a way of responding to key positions in RACS. It tracks all shared positions and allows real-time access to location and error data. PSI is built on a single DIP plugboard and replaces the Unimation controller. Response signals from six visual coders are used by PSI to determine the complete combined position and error detection. PSI also provides shared location data on RACS VAL communication link to operate in 'VAL-dependent mode'.

In literature [10] proposed a new concept of force feedback. The system can overcome the problems of another response system in an easy-to-use way. Force the laser distance sensor and sensor to transmit information from the gripper area to the tele operator using the power response module in the glove. Air pressure gives the operator distance information, while an actuator based on Magneto rheological Fluid (MR-Fluid) introduces a magnetic field. Indicates that the use of such a power reaction glove may be combined with a robot arm.

In literature [11], G. Sen Gupta, R. Paddison, C.H. Messom and S. Demidenko (2006) described the effectiveness of the proposed available robotic arm arm controlled by the prototype 6-DOF master unit. The robot arm imitates the art of the human hand and wrist. The professional control unit will be economical and operational in a wide range of fields in the medical, manufacturing, security, environment, entertainment and telecommunications ROV (Remote Vehicle) operation in offshore development or in an off-vehicle testing vehicle.

In literature [12], the introduction of the Raspberry Pi collects data from the site and analyzes the database. The program is based on an algorithm designed to lift an object. Then, using a web-based interface, Internet users can control the robot arm to benefit anywhere and anytime. The development of this robot is based on the AT-mega platform.

In literature [13] study the effectiveness of various government policies that restrict travel to their countries, especially those from countries with the COVID-19 certified epidemic. The strategic model is optimized using robots to identify patients with COVID-19. One of the best practices is concluding a combination of robot identification and migration limit.

In literature [14] also discusses lessons learned from epidemic control during COVID-19. Similarly, it is recognized that other countries have successfully delayed the spread of the epidemic, through the use of modern technology, e.g. robotic cleaners and face recognition systems, running a contact map and taking appropriate action.

A semi-automatic oropharyngeal swab robot was developed to take swabs test with the patients (Fig. 1) [15]. The remote camera is equipped with a swab robot, which helps medical personnel to make samples with clear vision but without close contact with the patient. The results of the collections are satisfactory, with their sample success rate being 95 percent.

Fig. 1: A semi-automatic swab robot [15].

In [16] a tele-ultrasound device was connected to the 5G network and a robot-assisted approach was proposed. In their practice, patients are located in private wards in different cities (Fig. 2). Ultrasound specialists, based in two other cities, have performed tele-ultrasound assisted by robots and remote consultations to perform early cardiopulmonary examinations.

Fig. 2: Robot-assisted tele ultrasound [16].

In literature [17] it also examined two cases of patients, who had COVID-19, with robotic ultrasound based on powerful 5G technology at a distance of 700 kilometers using a MGI robot. The benefits of long-distance ultrasound scanning have been demonstrated and can be a possible and safe way to diagnose and test COVID-19.

In literature [18] used 5G network and MGIUS-R3 robotic system to perform remote diagnosis. The proposed method can be performed on tests of the lungs, heart and blood vessels, while medical supplies are secure and resources / outcome can be easily distributed over the network. In the future, remote diagnoses can be aided by AI methods, e.g. image completion and pattern recognition. Meanwhile, haptic controls can be considered for the system to support medical personnel and improve diagnostic accuracy.

In literature [19] proposed an approach to perform quick response in the pandemic or bioterrorism scenario (Fig. 3). Robots and flexible machines are used to produce vaccines based on plants and trees automatically. Similar to the test device, the flexibility of the automatic production system can be improved with the adoption of remote control technology. At that point, the sensors can be re-programmed to monitor the production process and make quicker decisions.

Fig. 3: Automated modules for upside-down vacuum and infiltration [19]

In literature [20] proposed non-contact community robot to allow citizens to perform self-diagnosis and initiate remote diagnosis when necessary. The proposed method can detect speech, detect keywords, split coughs and convert user's cough sound into systematic data for future processing. Audio and video effects can be processed and detected by the AI network. Additionally, a rich collection of information can be stored based on a large data and cloud management system, providing reliable analysis.

III. CONCLUSION

The robots can be used for multiple applications which involve complicated tasks. As per operational requirements different types of robots are designed having multiple degrees of freedom. The recent application of robots was observed during COVID 19 pandemic where it was used for swab collection. Besides smart robots can be designed using artificial intelligence and other algorithms. Using robotic cleaners and facial recognition system pandemic was contained to a large extent.

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