Three Dimensional Mobile Controlled Robotic ARM for Cleaning Public Places

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Abstract: *Robotic vehicles are used in lifting of heavy objects and carrying out different industrial tasks. Mobile Robots are used to achieve magnificent accuracy and expert concentration. Mobile and Computer control saves time, money and energy. Also this reduces human efforts, man power and risks. Mobile and PLC based Robots are used to complete the task in all rapidly and with more accuracy. This is also helpful in hazardous and high temperature area where human being cannot work. [1]. Pick and place Robot is the most effective technology in industrial applications where it is specifically designed to be used in manufacturing industries for pick and place functions. This will reduce the human efforts in industrial operations in case of lifting the objects. The pick and place robot consists of a robotic vehicle and robotic arm placed on it, with a soft catching grip to grab the objects [3]. The robotic movements and pick and place functionality can be controlled by the Mobile application. This pick and place function is most useful in the industries in abnormal conditions and unusual places where a human being cannot enter such as in high temperature and narrow areas. RF technology GSM, DTMF, IP address such technologies are used to control and command the robotic operations. This technology is a hybrid technology which is mixer of paddle garden, vacuum cleaner and solar vacuum cleaner device. This technique Saves the electric energy and removes pipe-lining and wiring accessories. It has Hybrid Capillary Gripper for Liquid materials, Dust and small unwanted particles. It also has Hybrid ARM Gripper for solid and big hurdle particles. [4].*

Keywords: Hybrid Capillary Gripper, Hybrid ARM Gripper for solid materials, Latest Technology in Automation; six to twelve degree of freedom; mobile app automation; Liquid handing technology; Automotive Guided Vehicle; modern software techniques.

1. Introduction

Swatch Bharat Abhiyan, a big project is currently run by Indian Government. Three dimensional Robot consists of hybrid arm with 6-axis degree of freedom and each axis has 360 degree movement. Hybrid ARM consists of robotic mechanical body, servo and DC motors, hybrid ARM gripper. It has measuring device attached to the gripper to measure the movement of ARM gripper in degrees. Due to these advance features it attracts more attention for Robotic and automation research. It consists 6 motors and 6 relays to control and to follow the commands given by mobile application [4]. Hybrid ARM gripper is mixture of parallel and angular ARM gripper. Hybrid gripper grabs the object in the same manner done by human fingers. Hybrid gripper can rotate up to 180 degree. Automated guided vehicle type mobile application controlled robots are used in medical and chemical industry. Embedded C language is used to program the robot and one memory device is used to control and store the command given by mobile application. Pneumatic ARM and metallic magnetic gripper is used for carrying mechanical work. The output from transducers and object sensors may be too small & too noisy so artificial intelligence is used to operate gripper and ARM. Self-guided vehicle is used instead of automated guided vehicle. Self-guided vehicle apply the action or motion to mechanical processes through actuators and without any manual command. To lift cylindrical and spherical objects torque is measured by sensors and then pick place operation is followed [7]. Linear actuators such as disc drivers, valves, solenoids are used in mobile application automation. Spherical robot works on the polar coordinates.
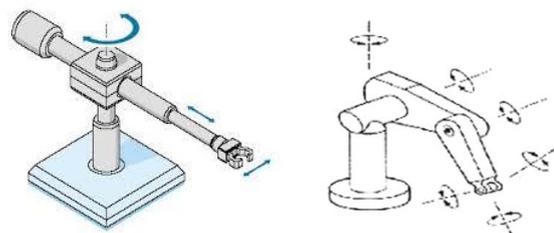

Figure 1: Hybrid Robotic ARM & Gripper

2. System Overview of Mobile App Control Robot

Motor control unit use full processor to control and observe motor speed. Motor driver compare the actual speed and standard speed of motor by using variable frequency drive. It gives a feedback to achieve zero errors in in industrial automation. Mobile application Robot is different from PLC and remote control Robot. It avoids more complexity and programming for each joint. Mobile application control Robot uses part programming which consists with list of co-ordinates values along the X, Y and Z directions of the entire tool path to finish the task. It can stop or run the programs immediately by using on-off controller. This electro-mechanical design can be used in CNC machine applications. Computer aided part programming is used to follow and control commands given by mobile application for automation. The range of Robot ARM is decided according to various applications and based on object parameters such as area, volume, weight etc. Aautomated guided vehicle (AGV) and latest version self-guided vehicle (SGV) are used as robotic vehicle to carry out task.

Hybrid Capillary Gripper

Hybrid capillary gripper is a magnetic liquid gripper. This sucks the liquid and store in vehicle. Capillary gripper is useful to clean liquid dirt and dust[5].

Hybrid ARM Gripper

It is combination of cylindrical and angular ARM Gripper. Instead of magnetic ARM gripper Hybrid gripper is used. With the help of this ARM gripper all type of materials (metallic and non-metallic) are picked and placed. Solid and liquid container easily handled. It is different from angular and parallel ARM Gripper. We can adjust tilt angle with the help of Mobile Application system.

Cylindrical & Spherical objects can move from one place to other. Web-Cam is used to observe the operations. Highly Automatic object sensors are used to Run & Stop the process.

Techniques and Algorithms

1) Euler langrage aalgorithm and ggenetic aalgorithm are used to pick and place the objects. Genetic algorithm is a latest & suitable technique for handling container carrying materials [6].
2) Angle of tilt is adjusted as per liquid or solid quantity. Operations are observed on TV or PC screen with the help of Web-Cam.
3) Hybrid ARM gripper: - It is combination of cylindrical and angular ARM Gripper. Instead of magnetic ARM gripper Hybrid gripper is used. With the help of this ARM gripper all type of materials (metallic and non-metallic) are picked and placed. Solid and liquid container easily handled. It is different from angular and parallel ARM Gripper. We can adjust tilt angle with the help of Mobile Application system.

Figure 2: Hybrid ARM
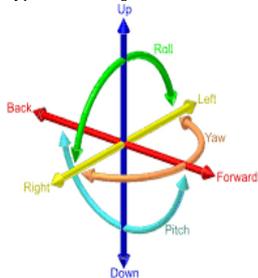
Figure 3: Degree of Freedom

4) Degree of Freedom:- It has six to twelve axis rotation. All joints have 360 degree rotation. Self-Guided Vehicle also has rotation of 360 degree.
5) Android developer like Mobi-one is used to develop mobile application to control Robotic operations.
6) Three dimensional Robotic ARM is used with hybrid gripper. It is connected to Robot vehicle with clips and magnets.

7) Instead of auto or remote control self-program control is provided. So avoidance of obstacle is possible.(SGV Algorithm and program).
8) An embedded memory device is used to store and utilize commands.

3. Equations

1) To grip 1litre liquid Robot required 2 litre vessel and capillary to store the liquid dust.
   Capillary Force is directly proportional to liquid strength and liquid quantity.
   Above formula is useful for to catch and carry the liquid form dust and dirt.
2) ARM gripper has sliding joints angle of 90 degrees so to pick the object best angle between two fingers is 90 degree and to place 0 degree.

COS (angle between two joints) = 0 for picking the object
COS (angle between two joints) = 1 for place the object.

4. 3-Dimensional Mechanical Structure

The main objective of the project is to design and construct a robotic ARM and which will be able to control the robotic movements and pic-place operation. The first object is very straight forward it requires the modern designing capacities. The complete robotic arm was first designed and assembled in designing software. The second objective requires knowledge of part or embedded programming through which commands are given. PID type controllers are used in industrial functions to control speed of motors, pick and place objects. Transducer switches are used to control movements of ARM while object sensors are used for self-guided vehicle (SGV).

Figure 4: Sensors and Actuators

Mobile controlled Robots are used in automobile industry with chain automation. It has 3 to 6 axis of degree of freedom. It rotates as per command in 3-D directions along X, Y and Z directions.

Degree of freedom is a term used to describe a robot's freedom of motion in 3 dimensional spaces specifically the ability to move forward and backward, up and down, left and right. Each joint required different DOF. Degrees of freedom defined modes in which a mechanical device or system can move. The number of degrees of freedom is equal to the total number of independent displacements or aspects of motion. A machine may operate in two or three dimensions but have more than three degrees of freedom. The term is widely used to define the motion capabilities of

robots. Consider a robot arm built to work like a human arm. Shoulder (Elbow joint) motion can take place as pitch (up and down) or yaw (left and right). Elbow motion can occur only as pitch. Wrist motion can occur as pitch or yaw. Rotation (roll) may also be possible for wrist and shoulder. Such a robot arm has five to seven degrees of freedom.

If a complex robot has two arms, the total number of degrees of freedom is doubled. In an android, additional degrees of freedom exist in the end effector, the legs and the head. Fully ffunctional androids and multi task mobile robots can have more than 20 degrees of freedom. Our primary objective is to make the Robotic arm, having two servo motors and a DC motor to interface with the ddevelopment of a micro-controller Robotic Arm. It provides more interfaces to the outside world and has larger mmemory to store many programs. More than 20 degree of freedom is used in automatic parking barrier system. End effector is the device at the end of a robotic arm designed to interact with the environment.

End effectors originates from robotic manipulators (robotic arm) It is the last link of the robot. It is a last link of the robot. It is similar to human hand with or without finger. It incorporates various sensors, transducers and follows all commands of mobile application. Reflective and transitive sensors are used in chemical and high temperature areas. In hazardous and narrow area 12- axes degree of freedom Robot with capacitive and inductive sensors are used. 20-axes degree of freedom is used for specific robot which designed in consider of applications.

5. Conclusion

In this presentation, the pick and place robot with android application controlled Robot is used for cleaning public places. This technology is useful for Government project *SWACH BHARAT ABHIYAN* and will be a smart robotic implementation in the field of robotics. It will be very useful in industrial purposes. It also consists with three dimensional moving arm robots. The android application interface added a smart finish to the pick and place robot. Use of Robotic ARM is economically viable in Indian conditions and can be used in rural area as recently cheaper smart phones are used by majority of the citizens.

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