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# Advancements in Robotic Drilling Machine

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**ABSTRACT:** Directional drilling machine which can be used for drilling holes in various locations and movements can be easily operate with high accuracy. Productivity can be improved by reducing total machining time, reduced human effort and reduced manufacturing cycle time. In this present age the application of micromachining operations continues to grow. These operations are required to fabricate the products required for sectors like medical science, automobile industries and electronics manufacturing etc. which deals with miniature trends. Drilling process is one of the machining processes which is used to drill micro holes not only in micro products but also in relatively larger work pieces which require ultra-small features which can be accomplished only by drilling process. In this methodology robotic drilling machine is developed. In this machine, the links are connected through joints. A servo motor is connected to the joints for movement of the links. The servo motors are controlled by Arduino. The drilling machine is fixed at the end effectors to drill holes in the required object. It is controlled by a dc motor. The supporting frame is hinged on to a base or a wall for easy rotation. The joints are moved to drill holes from point to point. The movement of the links is coordinated so as to drill holes at required points.

**KEYWORDS:**Drilling Machine, Development, Manufacturing.

## I. INTRODUCTION

In the industrial world, automation is one of the most important elements for development. It helps to reduce the need for humans and increase efficiency and productivity. The field of automation occupies large areas, mostly in industrial manufacturing and in addition to this; automation is applied to build a lot of sophisticated equipment which are used daily such as medical equipment (x-ray machines, radiography etc.), refrigerators, automobiles etc. Among all of these outcomes, the Robotic Drilling Machine is one of them, which is widely used for industrial proposes (1-2). A Robotic Drilling Machine can be compared to a human hand. It has a free rotating joint (rotation) and a translational joint (displacement) for the movement of the arm. This arm movement is usually driven by an electric driver (motor) or a pneumatic and a hydraulic system (pistons). These actuators are controlled by Arduino, usually programmable and made to perform a set of sequential tasks. There exist few challenges in a robot which limits its dominance in production sector. One of the challenges would be stiffness provided by the robot. During machining of any component there are various forces acting on the end effector, which reduce the machining quality (3). There are influences of drill temperature on hole quality under dry and wet drilling conditions. The results show that heat generated during wet drilling is less when compared to dry drilling, the hole quality also varies compared to both processes.

A Robotic Drilling Machine is constructed by using the arm and joints guided by using servo motors and programmed using Arduino. In the past years, drilling was done physically utilizing only traditional methods(4-5). In computerization field, drilling was made obligatory for fabrication parts. Recent advancement in technologies has driven mankind towards automation. As a part of automation, drilling is a crucial part in machining operations. , modern robot innovation could give a magnificent base to machining being adaptable. There exist few challenges in robot which limits its dominance in production sector. One of the challenges would be stiffness provided by the robot. During machining of any component there are various forces acting on the end effector, which reduce the machining quality(6-7). Response Surface Methodology is an optimizing technique and belongs to design of experiments strategy, where the study is concentrated on response produced by input parameters on drilling.

Robotics technology offers the opportunity to remove a good portion of the physically-stressing part of this work so that a environmentally protected, smaller crew can better cope with the mental requirements of the task(8). Similarly, in drilling operations people pride themselves in developing highly efficient crews by honing physical skill much like a sports team. The difficult environment tends to cause high turnover and, as a result, crews tend to be filled with people of limited skills. Robotics can reproduce the best crew on every rig, much like the factory robot manufactures all the parts the same--albeit, they may all be uniformly wrong if the robot is not correctly programmed.

## II. DESIGN OF ROBOTIC DRILLING MACHINE

A robot is a machine especially one programmable by a computer capable of carrying out a complex series of actions automatically. Robots can be guided by an external control device or the control may be embedded within. Robots may be constructed on the lines of human form, but most robots are machines designed to perform a task with no regard to their aesthetics. The branch of technology that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing is robotics. These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behaviour, or cognition. Many of today's robots are inspired by nature contributing to the field of bio-inspired robotics. These robots have also created a newer branch of robotics: soft robotics. Robots have replaced humans in performing repetitive and dangerous tasks which humans prefer not to do, or are unable to do because of size limitations, or which take place in extreme environments such as outer space or the bottom of the sea. There are concerns about the increasing use of robots and their role in society. Robots are blamed for rising technological unemployment as they replace workers in increasing numbers of functions. The use of robots in military combat raises ethical concerns. The possibilities of robot autonomy and potential repercussions have been addressed in fiction and may be a realistic concern in the future. Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work-piece, cutting off chips (swarf) from the hole as it is drilled.

In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from outside the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills. In rare cases, specially-shaped bits are used to cut holes of non-circular cross-section; a square cross-section is possible. Drilled holes are characterized by their sharp edge on the entrance side and the presence of burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks. Drilling may affect the mechanical properties of the work piece by creating low residual stresses around the hole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface. This causes the work piece to become more susceptible to corrosion and crack propagation at the stressed surface. A finish operation may be done to avoid these detrimental conditions. Robotic drilling machine consists of base plate, arm horizontal and vertical, motor, arduino, guider, servomechanism, actuators, and drill bit. It is shown in Fig.1



Fig. 1. Robotic Drilling Machine

## III. RESULTS AND DISCUSSION

This drilling machine possesses a radial arm which along with the drilling head can swing and move vertically up and down. The radial, vertical and horizontal arm movement of the drilling head enables locating the drill spindle at any point within a very large space required by large and odd shaped jobs. The tubular column on that the radial arm which moves up and down manually or it can powered movement then the drilling head here this is called drilling head which holds the drill spindle here in which the drill is mounted and is subjected to rotation. The entire head is mounted on the radial arm and this can move inward and outward from the drill axis. Also the horizontal arm can slide linearly on vertical arm. Not only that, as this along with this radial arm the drilling head moves upward and



downward to have large gap between the to drill and job or there is a stoke length. Not only that further this radial arm can be rotated about the column rotated about the column, say about 360 degree.

The main movements in the machine are

- 360 degrees rotation of arm joint.
- Up & down movement of the horizontal arm on vertical arm.
- Linear slide movement of horizontal arm.

Drilling machine with various positions for drilling as shown in Figs.2 (a) and (b)

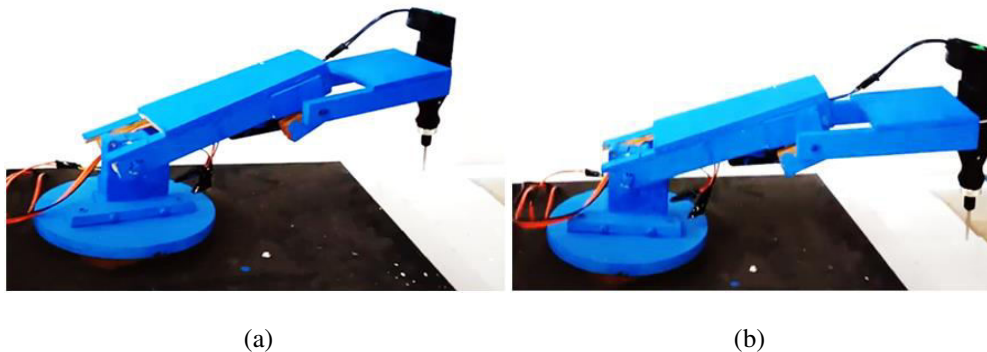


Fig.2. Drilling Machine with Varying Positions

- As the power supply starts, the dc motors rotates the drilling machine.
- The servo motors position the drilling machine to the required location as per programming in Arduino.
- The drilling is done with certain depth. This involves relative axial and rotational motions between drill and work piece.
- Chips are removed by flowing along grooves in drill bit.
- The drilling machine is next positioned to another point and drill hole as per the code.
- After the power is turned off, the drilling machine comes to rest

#### IV. CONCLUSIONS

Due to the various problems faced by conventional operation processes such as poor thread finish, more time consumption, frequent tool breakage and many more, we have decided to design a machine which will make use of simple programming. Above is the future model of robotic drilling machine on which the tapping, drilling, boring etc operation is achieved by programming and it eliminates all the problems faced by conventional operation process. This Drilling Machine is to be presented for increasing the productivity as well as quality of a job. It is an efficient operation and of competitive cost. Since a number of operation can be performed in a simple unit it is efficient and economical. Considering its uses and cost of the project, it becomes relatively cheap when compared to other units. The robotic drilling machine can be used to drill holes with accuracy. It is used to reduce the human effort by moving the drilling machine to required point. The movements are programmed in arduino. The arduino controls the servo motors to move them to the required position to perform drilling. The drilling machine can also be used to make a hole at any position by changing the program in arduino. Once the arduino is programmed, the drilling operation continues until the power is turned off. This makes it easy for a worker to use the robotic drilling machine. This type of drilling machine can also be used to make holes for long sheets. If to change the tool at the end effectors it can also be used to perform different machining operations. Robotic drilling machine applications are it is used in industries, drill holes for large metal sheets and also in other machining operations.

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