

DESIGN & FABRICATION OF AUTOMATED ATTACHMENT FOR POSITIONING BED OF DRILLING MACHINE WITH RESPECT TO CAD MODEL

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ABSTRACT

The prime objective of the paper is to introduce a special purpose attachment for drilling machine, which will convert any drilling machine into automated drilling machine. This machine will serve as a new solution in industry. Industrial automation has proven itself an essential part of the industries today. Its application has provided new solutions, making more concepts in manufacturing processes implementable. In this paper author proposing an automated attachment for drilling machine to position worktable with reference to CAD model. With detail study through literature review, analyzing, modeling, and experiments, the implementation of concept have delivered acceptable results. The drilling and positioning as per coordinate extraction program can achieve accurately with the precision of 1mm point to point. The drilling operation can be performed once points are selected and 'RUN' radio button click with delay less than 3 seconds. This system is designed for small scale industry for drilling plastics and aluminum parts, like heat sink of LED as an alternate solution to CNC machine at low cost.

Keyword :- Automation, Attachment, Coordinate Extraction and Radio button.

1. INTRODUCTION

Automation has become a key to unlock the manufacturing secrets and the way for determining the finest possibility of processing operation in the industries, that will lead to achieve high throughput, accuracy and repeatability in production. Automation leads to perform almost all associated activities in manufacturing industries. Such as Computer Aided Design, Computer Aided Process Planning and CNC machining centre are most popular these days, which can also work handsomely parallel with CAM software. While overcoming all parameters of manufacturing, automation has provided an advanced solution for performing nearly all operations like Milling, Drilling, etc. The most advanced version-drilling machine is CNC (Computer Numeric Control). The disadvantages of CNC machine, they are expensive and require a skilled operator for handling. Today the industrial growth purely depends upon latest machines; therefore, the subject of advanced machines is extending too widely.

This paper mainly focuses on the application of industrial automation for small-scale manufacturing units. As for the small-scale industries, drilling operations are most common and repetitiveness of the task can lead to countless

frustrations among the labourers particularly the beginners. Further, the time taken to drill a component can have a significant effect on the production. For performing drilling operation, there are manual drilling machine, which come in many shapes and sizes, from small hand-held power drills to bench mounted and finally floor-mounted model. As well, Automatic Drilling Machines available in market, which follow up, control the CAD/CAM process, and helps to machine the design product as per specification of the production process and financial capacities of the companies. The analysis of information flows shows that there are key gaps between the computer-aided design (CAD) and Manufacturing units, which indicates no solution linked CAD model directly to the machining. Hence we have design a '**Special Purpose Attachment**' particularly for lightweight 'Plastics and Aluminium', components that would transfer **16mm 500W Portable Bench (sensitive) Drilling Machine Model: BM20117** into Automated Drilling Machine. The Attachment will position Worktable directly from CAD model display on screen, without aid of part program.

2. MANUAL AND AUTOMATIC DRILLING MACHINE

2.1. Manual Drilling Machine.

2.1.1. Introduction: It is design for drilling small holes at high speeds in lightweight components. High speed and hand feed are necessary for drilling small holes. The base of the machine is mounted either on a bench or on the floor by means of bolts and nuts



Figure1: Portable Bench (sensitive) Drilling Machine

It can handle drills up to 15.5mm of diameter. The feed of depth to drill is given purely by hand into the work. The operator can sense the progress of the drill into the work because of hand feed.

2.1.2. Components:

Base: The base is made of cast iron and so can withstand vibrations. It may mount on a bench or on the floor. It supports all the other parts of the machine on it.

Column: The column stands vertically on the base at one end. It supports the worktable and the drill head. The drill head has drill spindle and the driving motor on either side of the column.

Table: The table is mounting on the vertical column and can be adjusting up and down on it. The table has 'T'-slots on it for holding the workpiece or to hold any other work holding device. The table can be adjusting vertically to accommodate workpiece of different heights and can be clamped at the required position.

Drill head: Drill head is mounted on the top side of the column. The drill spindle and the driving motor are connect by means of a V-belt and cone pulleys. The motion is transmitted to the spindle from the motor by the belt. The pinion attached to the handle meshes with the rack on the sleeve of the spindle for providing the drill the required down feed. There is no power feed arrangement in this machine. The spindle rotates at a speed ranging from 50 to 2000 r.p.m.

2.2. Automated Drilling Machine



Figure2: Automatic PCB drilling machine

2.2.1. Introduction: Automatic drilling machine is a device for making holes in components without human interface. Manually operated machine creates problems such as low accuracy, high setup time, low productivity, etc. A CNC machine overcomes all these problems but the main disadvantage of a CNC drilling machine is the high initial cost and requirement of skilled labour for operating the machine. The need for skilled operator is eliminated by providing a software with a more user friendly graphical user interface.

2.2.2. Components:

Mechanical Components: Its includes the structure of the drilling machine i.e. the base, support structure, beams, lead screw, bearing, gears, etc.

Electronics System: It consists of the motor, motor control unit, power unit and interfacing.

Controls or computing system: It positions the drilling end at the required position and it provides the depth of cut.

3. LITERATURE REVIEW: Literature review is the most important methodology as it provides the guidelines and evident supports for the research work, by extracting information on the relevant topic and work done on existing project.

3.1. With reference to paper by P.L.S.C Alwis, et al. on 'Automated Printed Circuit Board (PCB) Drilling Machine With Efficient Path Planning' SAITM –RSEA 2014. The author presents the design of a PCB drilling machine, where the drill holes from an image of the circuit detected automatically by eliminating the need to manually enter the drill hole coordinates. Further, the machine uses a path-planning algorithm, which is capable of estimating an efficient traversing path for the drill bit travel time.[1]

3.2 Gautam Jodh, et al. in their paper given details of 'Design of low Cost CNC Drilling Machine'. The important points identified are Design parameters Consideration and configuration selection from design point of view, and it suggest that the gantry configuration is most suitable for better rigidity, accuracy, and easy operation programming. The most useful finding is interfacing strategy of mechanism and controller can implement in the project. [4]

3.3. The paper of G.Niranjan, et al. on topic, 'Automated Drilling Machine with Depth Controllability'. It highlight the importance of depth of cut and its controllability for example, ' if a component is supposed to be drilled to a certain depth, doing it manually will takes lot of time, because each time depth has to be measured through a rough method, hence determining the drilling depth is quite complicated'. To eliminate problem the author suggest a way by controlling mechanical movements through programming the microcontroller, which will interfaced with drilling depth feed motor. [5]

3.4. N. Balasubramanyam_and Prof. Smt. G. Prasanthy has mention on topic 'Design and Fabrication of an Automatic PC-Based Drilling Machine', as follows The paper suggested that program can be prepared in 'C' language with a systematic approach that implemented to control motors independently. To drill the hole the coordinate data can be fed when the drilling head move back to the referred position. [6]

4. PROPOSED WORKING:

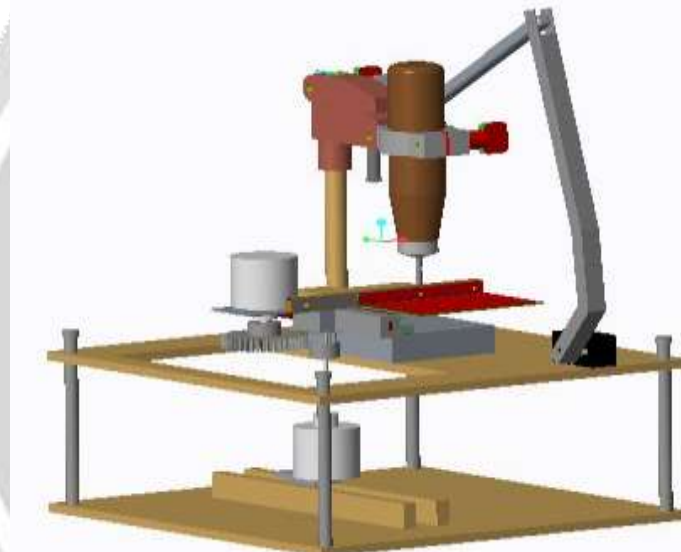


Figure3: Conceptual Drawing of Project.

The project is attempt to link CAD model to Machining end in case of Drilling Machine, while doing so initial concept has adopted that will convert and manual portable drilling machine into automatic drilling machine. For making, the project feasible its design flow has been dividing in three steps.

Step.1. Mechanism Of Drilling And Indexing:

It consist of two separation, first i.e. to control feed down mechanism of drill head, the manual handle is coupled with servo motor that is further control by interfaced microcontroller ATmega16. Secondly the indexing of worktable, two sliding assemblies that take transverse motion through Rack and Pinion mechanism. Both pinions are coupled with servo motors interface with ATmega16 controller. These servo motors take signal from electronics interface.

Step.2. Electronics Interfacing:

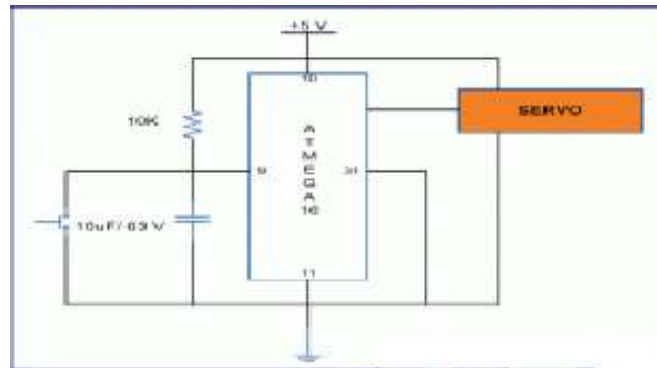


Figure5: ATmega16 interfacing with Servomotor.

[Servomotors](#) find huge applications in industrial automation. With the virtue of electronics interfacing indexing mechanism can be actuating. The servomotors are well known for their precise control and work on the principle of servomechanism. The servomotors can made to run at precise angle using PWM. The PWM (pulse width modulation) is the basic working principle behind a servo, which can be controlled through Microcontroller ATmega16.

Step.3. Display Screen Development:

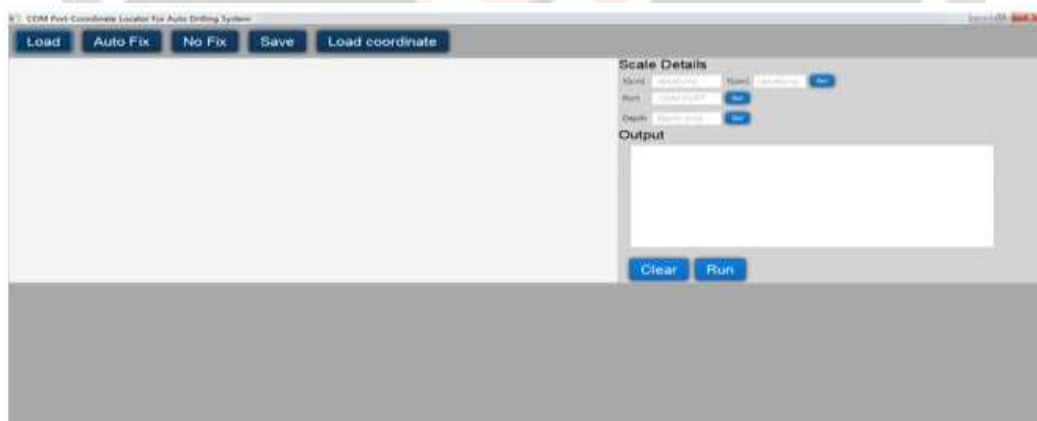


Figure6: Software window screen with CAD image.

An application from JAVA language will prepare to extract coordinates from the CAD model. This application will able to convert CAD image into system compatible format such as JPG, PNG and BMP. To get, X and Y intercept, click on the position where hole is required on CAD image. In accordance with the instruction send from window the signal collected by controller and indexing takes place. Hence drilling operation can perform automatically.

5. CONCLUSION:

Based on the above review papers the possibility of successful implementation of the project concept can be assure. We have identified the scope of project in small and medium scale industries. The main prospect of the project is to provide low cost automated solution as '**Special Purpose Attachment for Bench Drilling Machine**'. Which convert **16mm 500W Portable Bench (sensitive) Drilling Machine** in automatic drilling machine.

6. REFERENCES

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