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KLE TECHNOLOGICAL UNIVERSITY

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KLE Tech. CREATING VALUE LEVERAGING KNOWLEDGE

A Course Project Report on

"WORKTABLE POSITIONING SYSTEM"

Submitted by

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Control Systems

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ABSTRACT

As we all there is a great need of automation in the field of production majorly in basic and conventional machines such as lathe .The existing type of automation in the lathe machine is based on coded processing of both work table and tool. An important positioning system in manufacturing systems is the worktable motion control system.

So the focus of the project is on building a system which could tackle the problem of inaccurate movement of the work table according the feed given in code. For this purpose ultrasonic sensor based positioning system which would operate the screw rod of the work table after assumed position of the tool in reached to stop. This circuit was configured using a microcontroller and the coding was done using ardiuno.

CONTENTS

CHAPTER 1 INTRODUCTION:

The lathe is one of the most essential machine tools. This multi-purpose equipment is commonly used for executing a wide range of functions that includes shaping many solid substances such as wood, metal, etc. It is an important workshop tool which is extensively utilized in several industrial segments and especially in the metal shaping industries.

A small or large piece of metal can be shaped for producing the required kind of object. There are different ways and numerous processes to shape metals. Moreover, metal shaping is one of the methods that are used to manufacture a variety of products. Today, various kinds of metal shaping tools are available in the market. They enable us to create a vast array of metal products. These versatile tools assist to deform, turn, bend, twist, pound, roll and hammer the metal sheets into metal objects.

An important positioning system in manufacturing systems is the worktable motion control system. The system controls the motion of a worktable at a certain location. We assume that the table is activated in each axis by a motor and lead screw. We consider the x-axis and examine the motion control for a feedback system. The goal is to obtain a system response of the worktable position control system and position the worktable accordingly for the required operation.

PROBLEM STATEMENT :-

The task is to design a system which positions the work table according to the operation being performed and to obtain the transfer function along with the mathematical model for our system using matlab.

OBJECTIVES:-

Objectives are the intended attributes which the device must meet. They are:

1) It should be thoroughly automated.
2) It should be compact in design and simple in construction.
3) It should be accurate and easy to operate.
4) It should be easy to fabricate.
5) It should be reliable

SCOPE OF THE PROJECT:-

The scope of the project defines the boundaries or limits for the project to be conducted.

1) Should move to pre fixed/set position.
2) Should be built with minimum cost.
3) Should have precision in measurement.
4) Should be automated t maximum extent.

CHAPTER 2: LITERATURE

LITERATURE SURVEY:-

The survey was made to collect the information in the journal papers about the existing devices related to the project

SPECIFICATIONS:

Swing over bed	670 (26")
Swing over cross slide	400 (15")
Width of bed	400 (16")
Distance between centers	3000(118")
Spindle bore	Ø80(for 3" b) / Ø104(for 4" b)
Spindle nose	A1-8, D1-8 / A2-11
Spindle speeds (4 Steps)	16-1500 rpm / 13-1200 rpm
Ball screw diameter	X-axis : Ø32 (1-1/4") , Z-axis : Ø50 (2")
Cutting speed	X-axis : 0~5 m/min , Z-axis : 0~5 m/min
Max x-axis travel	350 (13")
Max z-axis travel	2800(110")
Tailstock spindle travel / Quill	230 (9") / Ø95 (3-3/4")
Tailstock spindle taper	MT#5
Controller	FANUC 0i-TD
Spindle motor	15KW
X-axis servo motor	FANUC αi8
X-axis servo motor output ※	1.6 KW
Z-axis servo motor	FANUC αi12
Z-axis servo motor output ※	3.0 KW
Coolant pump motor	1/4 HP
※ Our design enhances output torque	

METHODOLOGY

Methodology is a systematic analysis of methods to be carried out to design the final product. In order to carry out the project the steps followed are:

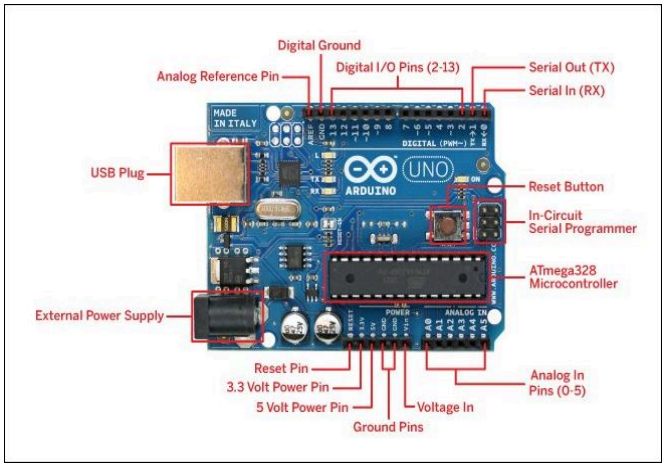
1) Identification of the problem
2) Need analysis
3) Scope of the project work
4) Literature review
5) Objectives
6) Estimation
7) Construction
8) Testing
9) Conclusion

FUNCTIONS:-

1) Detection of position of the work piece.
2) Initializing the screw rod of the work table.
3) Sensing the distance of the worktable during motion.
4) Switching off the motor when the worktable has reached its position.

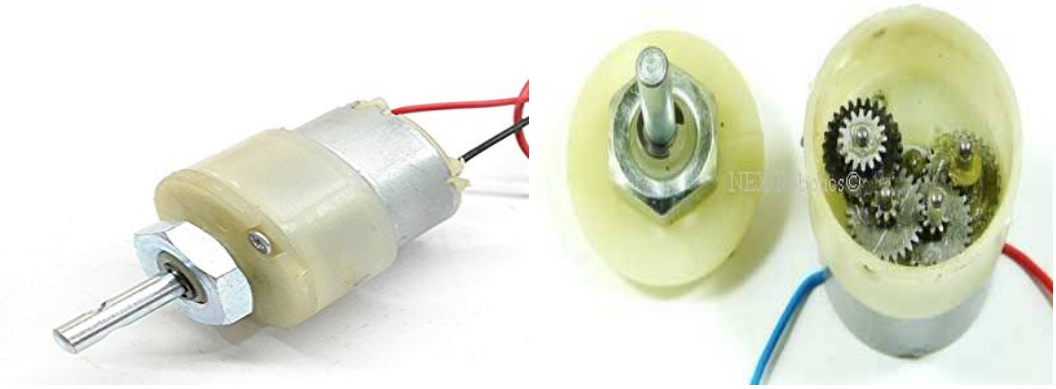
FABRICATION DETAILS:-

1) ARDUINO UNO:-



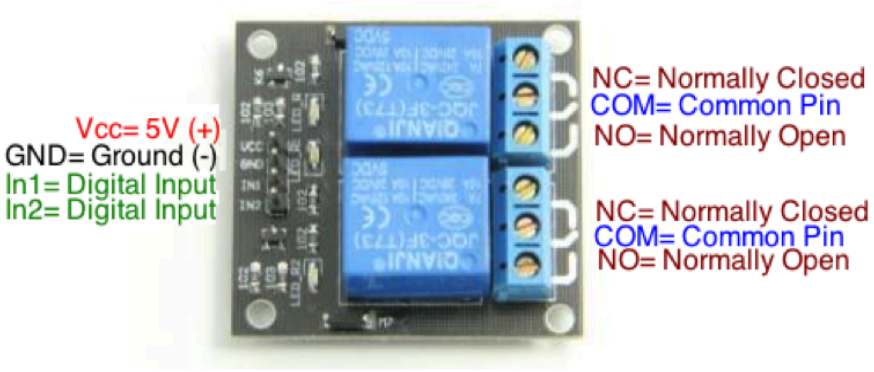
The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller.

2) DC MOTOR (60 RPM):-



A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

3) RELAY 2 CHANNEL:-

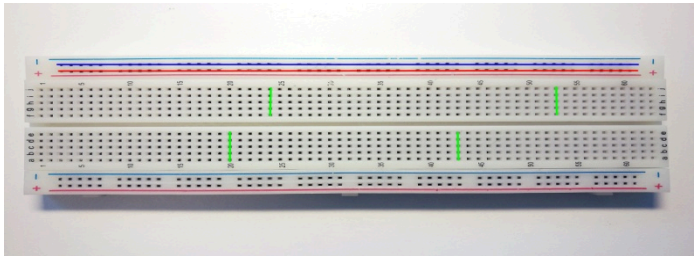


This is a 5V 2-channel relay interface board, and each channel needs a 15-20 mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC-250V 10A or DC-30V 10A. It has a standard interface that can be controlled directly by microcontroller.

4) ULTRASONIC SENSOR:-

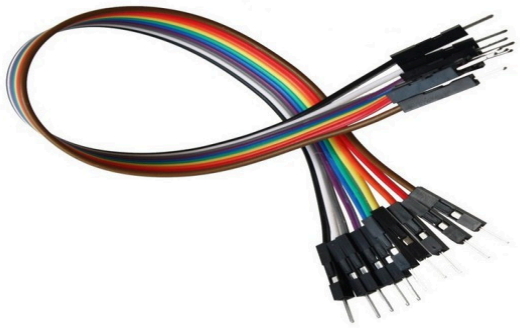
Precise distance(s) of an object moving to and from the sensor are measured via time intervals between transmitted and reflected bursts of ultrasonic sound. Distance change is continuously calculated and outputted.

5) BREADBOARD:-



A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode).

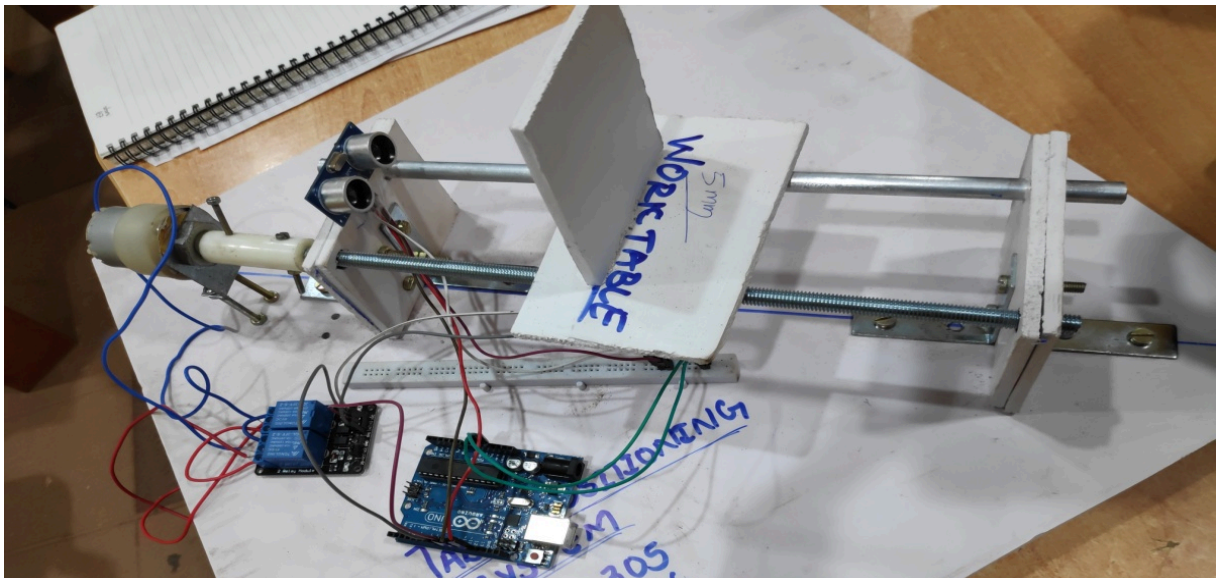
6)JUMPER WIRES :-



A jumper wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

FABRICATION PROCESSES:-

The process of fabrication Is simple we collected all the required items and started with the base , we took foam board 12 mm and cut it into 50*50cm square and then we took 4mm foam and cut into 10*10 cm square so as to support the motor and the hollow aluminum rod which is the main model off course . Then we drilled holes in the support boards for the threaded and hollow aluminum rods to pass, then we assembled the support foam board on the base foam board. Now we had to put the nuts into the threaded rods and after that we assembled the support board, base board and rods. After that we had to build the worktable for that we attached the foam board to the nuts on the threaded rod on that we attached a vertical board for the sensors to detect the position of the work table. Then the things left out where attaching the motor with the threaded rod and the connections of the motor ultrasonic sensor with relay and ardiuno uno. The connections were done with the help of circuit.io website.



COST ESTIMATION:-

Component Name	Cost Of Each Part	Quantities	Total Cost
Micro-controller	345	1	345
DC Motor	155	1	155
Relay 2-Channel	90	1	90
Foam-Board	150	1	150
Threaded Rod	50	1	50
Hollow Rod	30	1	30
Ultrasonic Sensor	60	1	60
Jumper Wires	3	10	30
Free Wires	3	10	30
Breadboard	50	1	50
Miscellaneous			100
TOTAL			**1090**

TESTING:-

The testing is carried out for the system by using the software **ARDUINO** which can be used to analyze circuit.

The designed circuit is fed into the system and the flow of current is analyzed and the points and which the probable problem can take place can be determined and eliminated.

The testing depicts the power in and out at each component of the circuit and the timer delay given and the output operation time can also be determined/ analyzed. This testing helps in selecting the best circuit design and achieve the output properly as planned for.

CONCLUSION:-

From the model we came to conclusion that positioning of the work table becomes automatic and easy also we learned the application of different controllers and the method of working of our model in some alternative ways. We also learned how to work as one team and also help and support each other where ever help needed.

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3) Intructables.in

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