DESIGN AND FABRICATION OF PNEUMATIC PICK AND PLACE ROBOT

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ABSTRACT-The aim of our project is the handling of materials and mechanisms to pick and place of objects from lower plane to higher plane and are widely found in factories and industrial manufacturing and it is control by a remote place using microcontroller. In the transmitting end, we are going to have three components namely keypad, bluetooth transmitter unit. The keypad is designed as per our convenience, such that it operates like a remote. From that it is given to an encoder unit and finally given to the receiver side. In the receiving end, we have an Bluetooth and the output of the receiver is given to a Decoder unit. The output from this unit is given to the array of relays, which can be operated as a switching device. The final output is then given to the appropriate pneumatic arms that is to be controlled. We are going to perform the operation by wireless type communication method. Nowadays control system plays a major role in various fields.

Keywords: Microcontroller,Bluetooth,Wirelesscommunication,Transciever

I INTRODUCTION

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased. Degrees of automation are of two types**1.**Full automation.**2.**Semi automation. In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

II. PROPOSED SYSTEM

NEED FOR AUTOMATION:

Automation can be achieved through computers, hydraulics, pneumatics, grippers, etc., ofthese sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa. Material handling concept and principle are the most important things in factory design. Material handling is one of the most lucrative areas for cost reduction in the average manufacturing plant. It offers the opportunity for the reduction of production cost. The movement of the material may be horizontal or vertical or combination of both. It has been estimated that about 60 – 70% of the cost of production is spent in Material handling activities. Material handling is the art and science of moving, packing and storing of products. Automation plays a vital role in mass production .for mass production of a product, the machining operations decides the sequence of machining .the machines designed for producing a particular product are called transfer machines.

NEED FOR MATERIAL HANDLING

- Reduction of labour ,material cost and over all cost
- Increased production
- Increased storage capacity
- Increased safety
- Improved personnel comfort

NEEDS FOR PNEUMATIC SOURCES

Pneumatic system use pressurized gases to transmit and control power, as the name implies, pneumatic systems typically use air as fluid medium, because air is a safe, low cost and readily available fluid. It is particularly safe environments where an electrical spark could ignite leaks from the system components. There are several reasons for considering the use of pneumatic system instead of hydraulic system. Therefore, in hydraulic system the weight of the oil is a potential problem. To design and development a material handling system for automation /semi automation of industries by using pneumatic control system, which is used for low cost automation

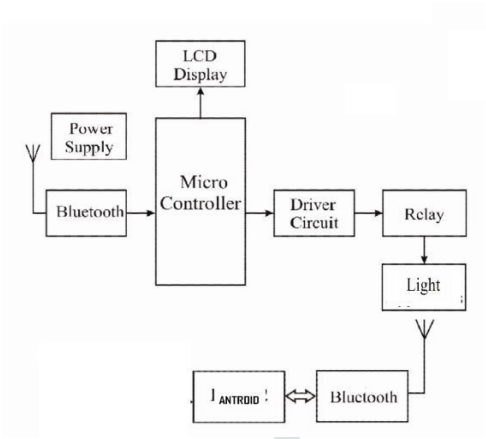

Fig:1: Block diagram of pneumatic pick and place robot

MICROCONTROLLER: A microcontroller is a complete microprocessor system built on a single IC. Microcontrollers were developed to meet a need for microprocessors to be put into low cost products. A microcontroller is a Computer-On-A-Chip, , a single-chip computer, here we used 8051 microcontroller to control the entire circuit , it act as human brain.

DRIVER CIRCUIT:

IT consist of three dc motor , the 12volt power supply is given to the motor. Using the motor it is moved to one place to another, it works in 30rpm.

SOLENOID VALVE:

We have used 5/2 solenoid valve as the directional control valve.Voltage=12 v Frequency=50 Hz,Maximum Operation Pressure=10 bar,Port size=7mm.the control valve is used to control the flow direction is called cut off valve or solenoid valve. This solenoid cutoff valve is controlled by the electronic control unit. In our project separate solenoid valve is used for flow direction of vice cylinder. It is used to flow the air from compressor to the single acting cylinder

TRANSMITER AND RECEIVER UNIT:

These RF transmitter & receiver will suit one-to-one and multi-node wireless links in such applications as car and building security, inventory tracking, remote industrial process monitoring and data networks etc. RF, is a frequency or rate of oscillation within the range of about 3 Hz and 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves.

RELAY:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first.

PICK AND PLACE ARM:

IT Is used for purpose of gripping or handling of the object.it is connected with the connecting rod with the help of spur gear.

SPUR GEAR:

The spur gear is used to speed reduction and torque multiplication and to reduce the noise and stress in the gear.

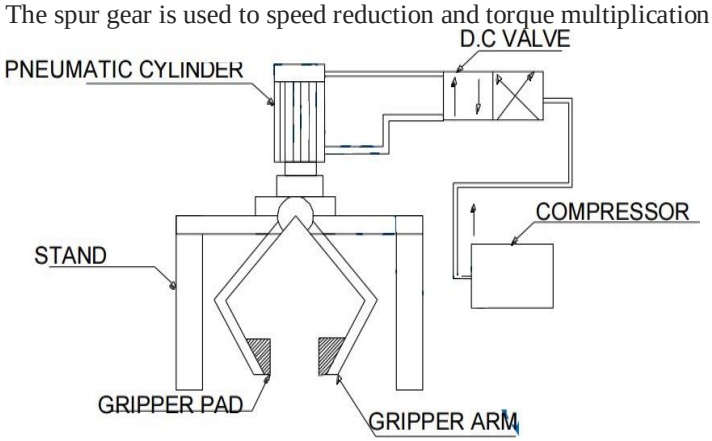

Fig: 2: Pick and place arm

RECIPROCATING COMPRESSORS:

Built for either stationary (or) portable service the reciprocating compressor is by far the most common type. Reciprocating compressors lap be had is sizes from the smallest capacities to deliver more than 500m^3/min. In single stage compressor, the air pressure may be of 6 bar machines discharge of pressure is up to 15bars.Discharge pressure in the range of 250bars can be obtained with high pressure reciprocating compressors that of three & four stages. Single stage and 1200 stage models are particularly suitable.

1II. DESIGN CALCULATION

1. PNEUMATIC DOUBLE ACTING CYLINDER

DESIGN OF PISTON ROD:

Load due to air Pressure

Diameter of the Piston (d) = 20 mm

Pressure acting (p) = 6 kgf/cm²

Material used for rod = C 45

Yield stress (σ_y) = 36 kgf/mm²

Assuming factor of safety = 2

Design Stress(σ_y) = σy / F0 S

= 36 / 2 = 18 Kgf/mm²

= P / (Π d² / 4)

$\therefore$ d = $\sqrt{4\,p / \Pi[\,\sigma_y\,]}$

= $\sqrt{4 \times 75.36 / \{\Pi \times 18\}}$

= $\sqrt{5.33}$ = 2.3 mm

$\therefore$ Minimum diameter of rod required for the load = 2.3 mm

We assume diameter of the rod =15 mm

DESIGN OF CYLINDER THICKNESS:

Material used =Cast iron

Assuming internal diameter of the cylinder =20 mm

Ultimate tensile stress = 250 N/mm² = 2500 gf/mm²

Working Stress = Ultimate tensile stress / factor of safety

Assuming factor of safety = 4

Working stress (f_t) = 2500 / 4=625 Kgf/cm²

According to 'LAMES EQUATION'

Minimum thickness of cylinder (t) $=ri \{\sqrt{(f_t + p) / (f_t - p)} -1 \}$

Where,

ri =inner radius of cylinder in cm.

f_t = Working stress (Kgf/cm²)

p =Working pressure in Kgf/cm²

∴ Substituting values we get,

t $=2.0 \{ \sqrt{(625 + 6) / (625 - 6)} -1\}$

t =0.019 cm=0.19 mm

We assume thickness of cylinder = 2.5 mm

Inner diameter of barrel = 20 mm

Outer diameter of barrel = 20 + 2t =20 + (2 x 2.5)=25 mm

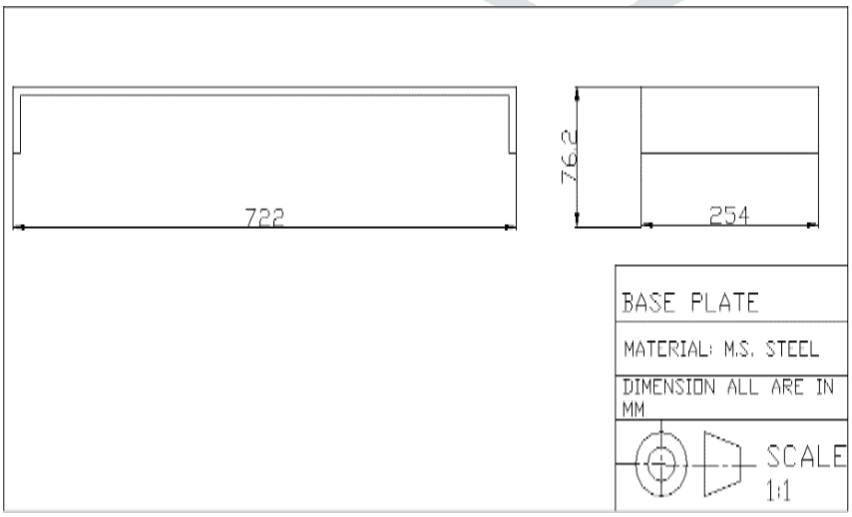

Fig:3: Mild steel base plate

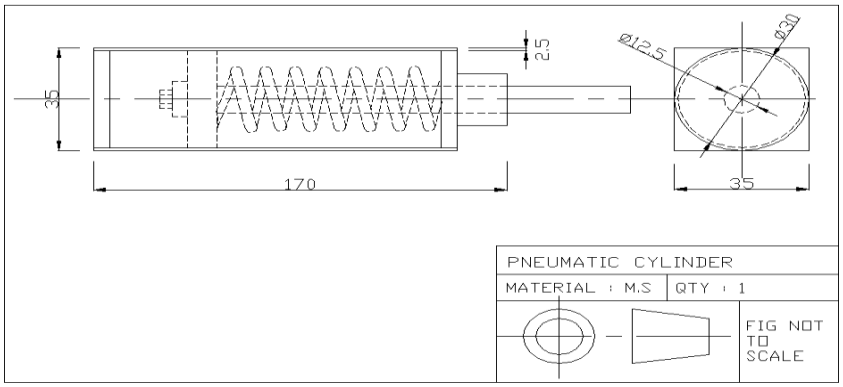

Fig:4: Pneumatic cylinder inner diameter

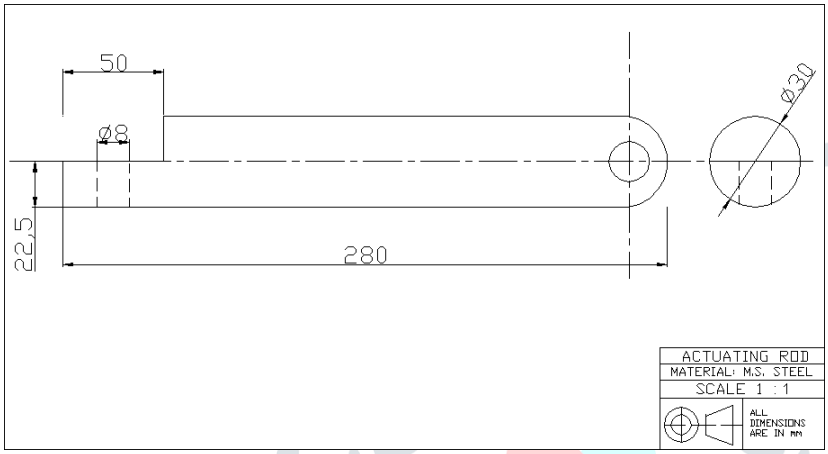

Fig:5:actuvating rod

VI RESULT AND OBSERVATION:

The pneumatic pick and place robot provide a high efficient mechanical process for move andplace the materials in effective time and cost, due to this we can eliminate the delay of man power and increase the production of materials

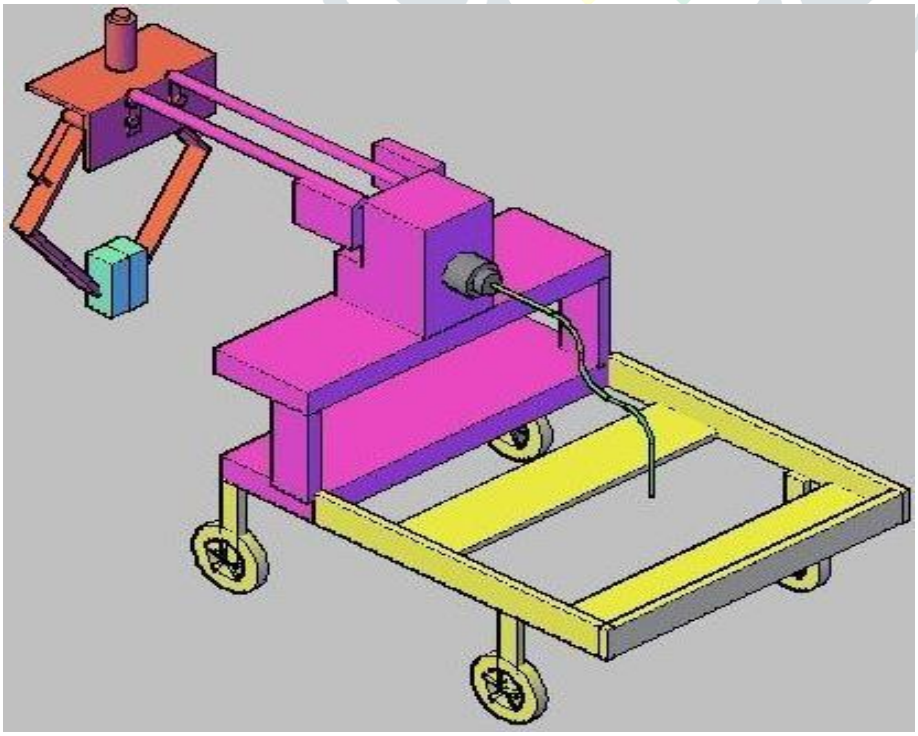

Fig:6:3D Diagram of pneumatic pick and place robot

IV. CONCLUSION:

The design of a Remote Controlled Robotic Vehicle has been completed. A prototype was built and confirmed functional. This system would make it easier for man to unrivalled the risk of handling suspicious objects which could be hazardous in its present environment and workplace. Complex and complicated duties would be achieved faster and more accurately with this design.

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