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Research Paper

"Theautomaticpneumatic bumper and breaking"

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ABSTRACT- *The technology of pneumatics plays a majorroleinthefieldofautomationandmodern machine shops and space robots. The aim is to design and develop a control system based on intelligent electronically controlled automotive bumperactivationandautomaticbrakingsystemis called AUTOMATIC PNEUMATIC BUMPER AND BREAK ACTUATION BEFORE COLLISION. This project consists of an IR transmitter and Receiver circuit, Control Unit, a Pneumatic bumper system, and a pneumatic brakingsystem.The IRsensorsensestheobstacle. Thereisanyobstaclecloserthevehicle(within 3-4feet),thecontrolsignalisgiventothe bumper activation system and also pneumatic braking systemsimultaneously.Thepneumaticbumperand braking systemareusedtoproducetheman and vehicle. This bumper and braking activation system is only activated the vehicle speed above 30-40kmperhour.Thisvehiclespeedissensedby theproximity sensorandthissignalisgiventothe control unit and pneumatic bumper and braking activationsystem.*

KEYWORDS*:IRtransmitter,IRsensor,bumper,and proximitysensor.*

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I. INTRODUCTION

Wehavethepleasureofintroducingourproject"AUTOMATIC PNEUMATICBUMPERANDBREAKING SYSTEM". WhichisfullyequippedbyIRsensorscircuitandPneumatic bumperandbrakingactivationcircuit? Itistheprojectwhich hasbeenfullyequippedanddesignedforautovehicles.The technologyofpneumaticsplaysamajorroleinthefieldof automationandmodernmachineshopsandspacerobots.The aimistodesignand developacontrolsystembasedon intelligentelectronicallycontrolledautomotivebumper activation systemiscalled"automaticpneumaticbumperand break actuationbeforecollision".Theprojectconsistsof IR transmitterandReceivercircuit,ControlUnit,Pneumatic bumpersystem.TheIRsensorsensestheobstacle.There is anyobstaclecloserthevehicle(within1feet),the control signalisgiventothebumperandbreakactivation system. Thisbumperactivationsystemisactivatedwhenthevehicle speedabove40-50kmperhour.Thespeedis sensedbythe proximitysensorandthissignalistransfertothecontrolunit andpneumaticbumperactivation system.

1.1 INTRODUCTION STOSAFETY SYSTEM

Theaimistodesignanddevelopacontrolsystembased on pneumaticbreakingsystemofanintelligentelectronically controlledautomotivebrakingsystem. forcomparisonof iterativetechnologies/techniques.Thefinalphaseofthenew modernvehicleshallinclude: •Developmentofimproved ABScontrolsystems •Developmentandassessmentofan electro-hydraulic- BBW(EH-BBW)system

- Individual wheel braking combined with traction control
- Assessing sensor failure and fault tolerant control system design
- Preliminarystudiesintoanelectricallyactuatedsystem
- Re-engineeringusingsimplifiedmodels.

1.2PNEUMATICS

Theword'pneuma'comesfromGreekandmeans breatherwind,forautomation. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure tosuitthecapacityofthe system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary todeal withthe questionofcompressedairsupply.

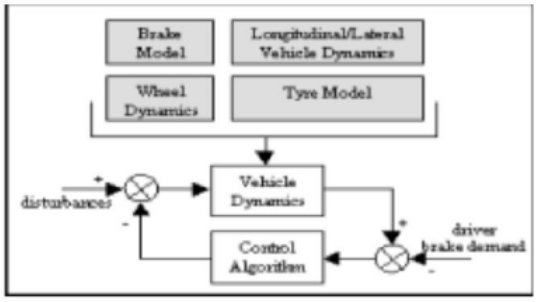

Fig 1.Automation

the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

Theusualwrittenas

$PV=C(or)P_1V_1=P2V2$

Inthisequationthepressureistheabsolute pressured whichforfree.

1.3.IRSENSOR

Asensorisatransducerusedtomakea measurement ofaphysicalvariable.

ofthevehicle

Fig2.Sensor

Types ofsensor:Passivesensorsdetectthe reflected or emitted electro-magnetic radiation from natural sources, while active sensors detect reflected responses from objects which are irradiated from artificially generated energy sources,suchasradar.

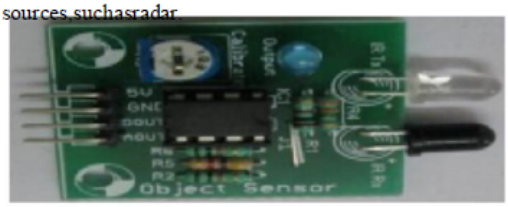

Fig3.Sensorcomponents

The most popular sensors used in remote sensing are the camera, solid-state scanner, suchastheCCD(charge-coupled device)images,themulti-spectralscannerandin thefuturethe passivesyntheticaperturer adar.

Lasersensorshaverecentlybeguntobeusedmorefrequently formonitoringairpollutionbylaserspectrometersandforthe measurementofdistancebylaser altimeters.

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1.4CHARACTERISTICSOFOPTICALSENSOR:

Opticalsensors arecharacterized specified by spectral, radiometricand geometricperformance the spectral characteristicsarespectral band and bandwidth, thecentral wavelength,response sensitivity attheedges ofband, spectral sensitivityatouter wavelengths and sensitivity ofpolarization . Sensorsusing film are characterized bythesensitivity offilm andthe transmittance ofthefilter, and natureofthelens . Scanner type sensors arespecified bythespectral characteristicsof thedetector and thespectral splitter.In addition, chromatic aberration isaninfluential factor. Theradiometriccharacteristicsofopticalsensorsare specified by the change of electro-magnetic radiation which passes throughanopticalsystem.Theyare radiometryofthesensor, sensitivityinnoiseequivalent power,dynamicrange,signalto noise ratio (S/N ratio) and other noises, including quantification noise . elements. IFOV is definedastheangle contained by the minimum area that can be detected by a scanner type sensor. For example inthecaseofanIFOVof 2.5 milli radians,the detectedareaonthegroundwillbe2 .5 metersx2.5 meters,ifthealtitudeofsensoris1,000mabove ground. InourprojectIRtransmitterandIRreceiverareused to detecttheobstacle .Thesesensorsarefittedatthefront side .

1.5IRTRANSMITTER ANDIRRECEIVER The IR transmittingcircuit isused inmany projects .TheIR transmittersends 40kHz (frequencycan beadjusted) carrier under555 timercontrol .IRcarriersataround 40 kHz carrier frequenciesarewidely used inTV remote controlling and ICs forreceiving these signals arequite easily available .

The transmitted signal reflected by the obstacle and the IR receivercircuitreceivesthesignalandgivingcontrol signalto the control unit. The control unit activates the pneumatic breakingsystem, sothat break was applied.

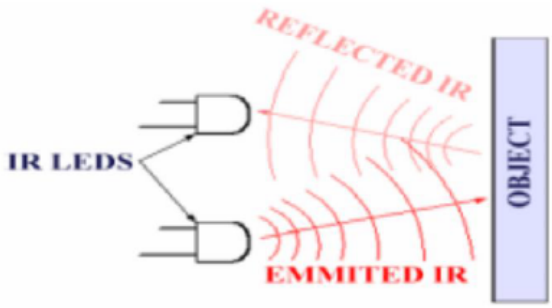


Fig4.IRSensor Rays

2.COMPONENTSANDDESCRIPTION

i) SELECTION OF PNEUMATICS: Mechanization is broadly defined as the replacement of manual effort by mechanicalpower.Pneumaticsisanattractivemedium forlow cost mechanization particularly for sequential or repetitive operations. may be economic and can be advantageously applied to other forms of power).The mainadvantagesofan all-pneumaticsystemareusually economyandsimplicity,the latter reducing maintenance to a low level. It can also have outstandingadvantagesin termsofsafety.

ii)PNEUMATICCOMPONENTSANDITSDESCRIPTION

Thepneumaticbearingpressconsistsofthefollowing componentstofulfilltherequirementsofcomplete operation ofthemachine.

1. Pneumatic single acting cylinder, 2Solenoidvalve3.Flow control valve 4. IR sensor 5.unit Wheel and brake arrangement 6.PU connector, 7.reducer, 8.hose 9.collar 10.Stand11.Singlephaseinductionmotor.

iii)PNEUMATICSINGLEACTINGCYLINDER:Pneumatic cylinderconsistofA)PISTONB)CYLINDER

ThecylinderisaSingleactingcylinderone,whichmeans that theair pressureoperatesforwardandspringreturns backward. The air from the compressor is passed through theregulator whichcontrolsthepressuretorequired amountbyadjustingits knob. A pressure gauge is attached to the regulator for showing thelinepressure.Thenthe compressedairispassed throughthesingleacting3/2 solenoidvalveforsupplyingthe airtoonesideofthe cylinder.

Fig5.SingleActing Cylinder

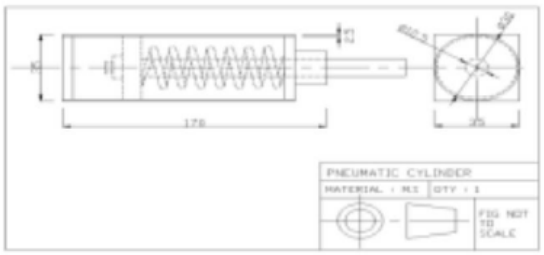
OnehosetaketheoutputofthedirectionalControl (Solenoid) valve and they are attached to one end of the cylinder by means ofconnectors .Oneoftheoutputsfrom thedirectional controlvalveistakentotheflowcontrol valvefromtakento the cylinder. The hose is attachedto each component of pneumaticsystem only byconnectors.

TECHNICALDATA:Doubleactingpneumaticcylinder

Stroke length : Cylinder stoker length 160 mm = 0.16 m ,Quantity:1,Seals:Nitride(Buna-N)Elastomeric,End cones: Cast iron,Piston:EN–8Media:Air ,Temperature:0-80°C ,PressureRange: 8N/m².

Fig6.PneumaticCylinder

iv)



Transmitterandreceiverishighduetothenonconductivityof theIRwaves.

C)WHEELANDBRAKINGARRANGEMENT:Thesimple wheelandbrakingarrangementisfixedtotheframe stand.

SOLENOID VALVE WITH CONTROL UNIT: The directional valveisoneoftheimportantpartsofa pneumatic system.

Fig7.solenoid valve

Thesearealsousedtooperateamechanicaloperation which in turnoperatesthevalvemechanism.

v) BRAKES: Brake is a mechanical device which inhibits motion,slowingorstoppingamotionobjectorpreventing its motion. Brakeisgenerallyappliedtorotatingaxlesor wheels, butmayalsotake otherformsuchasthesurfaceof amoving fluid.

Vi)IRSENSORUNIT:TheIRtransmitterandIRreceiver circuitisusedtosensetheobstacle.

A) NORMAL CONDITION: The IR transmitter sensor is transmitting the infrared rays with the help of 555 IC timer circuit.

B)OBSTACLECONDITION:AtObstacleconditionstheIR transmitterandIRreceiver,theresistanceacrossthe

D)PUCONNECTIORS,REDUCERANDHOSECOLLAR:

In our pneumatic system there are two types of connectorsused;oneisthehoseconnectorandtheother isthe reducer.

E)STAND:Thisisasupportingframeandmadeupofmild steel.

F)IC555TIMER: TheICSE/NE555monolithiccircuitis a highly stablecontrollercapableofproducingaccurate time delays or oscillations. Additional terminals are provided for triggering or resetting if desired.both accuratelycontributed with theexternalRCconstants.

PINDIAGRAM:

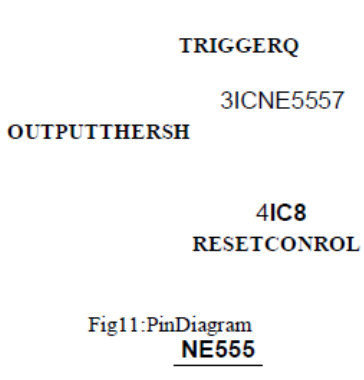


Fig11:PinDiagram
NE555

INNO:1itisgroundterminal.

PINNO:2thetriggervoltagetothelowercomparatoris applied.Ithasconstantvoltagethatisatleastonethird ofthesupply voltage,when triggervoltagefallsbelow thisleveltheflip-flopchangesitsstateandoutput becomeshigh.

PINNO:3Itistheoutputterminal,inlowstateoutputis equaltozeroandwhenathigherstateoutputisequalto Vcc.

PINNO:4Itcontrolstheflipflopdirectly.Itturnsthe devicetoitsoriginalpositionwhenresetpinis connectedtogroundthe outputis approximatelyequal tozero.Whenresetisnotuseditisconnectedto Vcc.

PINNO:5Itisthecontrolvoltageterminal.Itisconnected togroundthroughacapacitorof0.01μF.Anyexternal voltageatpin: 5willchange boththethresholdvoltage andthetriggervoltagereferencelevel.

PIN NO:6Thresholdvoltageofuppercomparatoris appliedfromthisterminal.TheresistorRtconnectedto Vccandpin:6is grounded by an external capacitor. The output is high capacitor charges by resistor Rt. When the capacitor changes to the thresholdlevel,theoutput becomeslow.

PINNO:7Itisthedischargepinforexternalcapacitor. Usuallypin:7isconnectedwithpin:6directlytobya resistor.Whenthe output becomes low then the external capacitor discharges by internal discharge transistor remainsatcut-offandtheexternal capacitor chargesto Vcc.

PINNO:8Itisthepositivesupplyterminal.Adcvoltage from+5to+15canbeapplied.Theimportantfeaturesof IC555canbe summarizedas follows.

1.Timingrangefrommicrosecondstohours.2.MonostableandActableoperationsarepossiblethroughIC555.3.Thedutycycle canbeadjustedaccordingtoour necessity.4.Ithastheabilitytooperatefromawiderange ofsupplyVoltage.5.Theoutputof555 is compatible with CMOS, DTL and TTL, logic. 6.Output can be operatedas normalONandnormalOFF.7RCtimers,555 providea timeintervalsthatisvirtuallyindependenceofSupply voltageVcc.Thisbecausethat,thechargerateofCTand the referenceVoltage tothethresholdcomparatorareall directlyproportionaltothesupplyVoltage.

3.WORKINGPRINCIPLE Thecompressedairfromthe compressoratthepressureof5to7barispassedthrough apipe connectedtotheSolenoidvalvewithoneinput.The SolenoidValveisactuatedwithControlTimingUnit.The Solenoidvalvehastwo outputsand oneinput.Theair enteringintotheinputgoesoutthroughthetwooutputs whenthetimingcontrolunitisactuated.Dueto thehigh airpressureatthebottomofthepiston,theairpressure belowthepistonismorethanthepressureabovethe piston.Sothese movesthe pistonrodupwardswhich moveuptheeffortare,whichispivotedbycontrolunit. Thisforceactingispassedonto punch/rivetwhichalso movesdownwards.TheIRTRANSMITTERcircuitisto transmittheInfra-Redrays.Ifanyobstacleistherein a path,the Infra-Redraysreflected.ThisreflectedInfra-Red raysarereceivedbythereceivercircuitiscalled"IR RECEIVER".The IRreceivercircuitreceivesthereflected IRraysandgivingthecontrolsignaltothecontrolcircuit. Thecontrolcircuitisusedto activatethe solenoidvalve. Theoperatingprincipleofsolenoidvalveisalready explainedintheabovechapter

Ifthesolenoidvalveisactivated,thecompressedair passesto the Single Acting Pneumatic Cylinder. The compressed air activatesthepneumaticcylinderand movesthepistonrod .If the piston moves forward, then the breaking arrangement activated. The breaking arrangement is used to break the

wheelgraduallyor suddenlyduetothepistonmovement .The breaking speed is varied by adjusting the valve is called "FLOW CONTROL VALVE". In our project, we have to applythisbreaking arrangementinonewheelasamodel .The compressedair drawnfromthecompressorinourproject .The compressedairflowthroughthePolyurethanetubetothe flow controlvalve .

4)DESIGN&ANALYSIS

PNEUMATICCYLINDER:

i)DesignofPistonrod:

Loadduetoairpressure.

DiameterofthePiston(d)=40mm

Pressureacting(p)=6kgf/cm²

Materialusedforrod=C45

Yieldstress(σ_y)=36kgf/mm²

Assumingfactorofsafety=2

Forceactingontherod(P)=PressurexArea=

$=px(\Pi d^2/4)$

$=6x\{(\Pi x4^2)/4\}$

p=73.36Kgf

DesignStress(σy)=σy/F0S

=36/2=18Kgf/mm²

ft=Workingstress(Kgf/cm²)

p=WorkingpressureinKgf/cm²

∴Substitutingvalueswe get,

t=2.0{√(625+6)/(625–6)-1}

t=0.019cm=0.19mm

Weassume

WeassumeThicknessofcylinder=2.5mmInner

diameterofbarrel=40mm

Outerdiameterofbarrel=40+2t

=40+(2x2.5)

$=P/(\Pi d^2/4)$

∴$d=\sqrt{4p/\Pi[\sigma y]}$

$=\sqrt{4x75.36/\{\Pi x18\}}$

$=\sqrt{5.33}=2.3mm$

∴Miniimumdiameterofrodrequiredfortheload=2.3mm

Weassumediameteroftherod=15mm

ii)Designofcylinderthickness:

Materialused=Castiron

Assuminginternaldiameterofthecylinder=40mmUltimate tensilestress=250N/mm²=2500gf/mm²WorkingStress =Ultimatetensilestress/factorofsafetyAssumingfactorof safety=4

Workingstress(ft)=2500/4

=625Kgf/cm²

Accordingto'LAMESEQUATION'

Minimumthicknessofcylinder(t)=

Ri{√(ft+p)/(ft–p)-1}

Where,Ri=innerradiusofcylinderincm.

=45mm

iii)Lengthofpistonrod:

Approachstroke=160mm

Lengthofthreads=2x20=40mm

Extralengthduetofrontcover=12mm

Extralengthofaccommodatehead=20mmTotallengthof thepistonrod=160+40+12+20=232mm

Bystandardizing,lengthofthepistonrod=230mm**5)**

LISTOFMATERIALS:

Thelistofmaterialsorcomponentsusedinautomatic pneumaticbumper&brakeactuationbeforecollision.

Tablenol:List ofmaterials

Sl. No.	PARTS	Qty.
i.	SingleActing Pneumatic Cylinder	2
ii.	FlowControl Valve	1
iii.	Wheel	4
iv.	SolenoidValve	2
v.	SinglePhase induction motor	1
vi.	SensorUnit	1
vii.	Pulley	2
viii.	PolyethyleneTube	-
ix.	HoseCollar and Reducer	-
X	Stand(Frame)	1
Xi	IRsensor	1
Xi i	Diskbrake	1
Xiii	Ironrods	-

5.1)COST EQUIPMENT:

Thecost material isselected aspertheprice listof2015 .

Tableno2:MATERIAL COST:

Sl. No.	PARTS	Qty.	COST(Rs)
i.	SingleActing Pneumatic Cylinder	2	3000
ii.	FlowControl Valve	1	300
iii.	Wheel	4	8000
iv.	SolenoidValve	2	1100
v.	SinglePhase induction motor	1	2200
vi.	SensorUnit	1	1800
vii.	Pulley	2	700
viii.	PolyethyleneTube	-	400
ix.	HoseCollar and Reducer	-	500
X	Stand(Frame) including fabrication cost	-	3000
Xi	Wires,nut& bolts , electrodes&other	-	1000

ableto increase thepre-crashsafety.4.Systemable to providemore safety tothepassengers .
5.Systemplays animportant role tosave human
6.Lifeinroad accidents .

6.1)LIMITATIONS

1.Systemhas few limitationsinthedensely -trafficroad .
2.Systemhasnoprovision toprevent and curetheaccidents fromrear side ofvehicle .
3.Hardand thick materials cannot beriveted .4.Duetothe linkagesthere will befrictional losses.
5.Maintenancewill bemore due tothenumber ofmoving parts.
6.Strokelength isfixed .

6.3)APPLICATIONS

1.Thissystem maybeapplicable inalltypes vehicleslike cars, Rickshaws, Tempos.
2.Thissystem also successfullyinstalled inthe vehicleslike buses,trucks, trailers, etc.

6)ADVANTAGES

1.ItabletoIncreasethesurenessinbraking system.
2.Brakingsystemabletogivefastresponse.3.System

7.CONCLUSION

Thisproject work hasprovided usanexcellent opportunity

thatwehavecompletedthework withintimesuccessfully.

ThePNEUMATICBUMPER& BRAKEFORFOUR WHEELERisworkingwith satisfactoryconditions.Thuswe havepreparedan "PNEUMATICBUMPER&BRAKE

FORFOURWHEELER"whichhelpstoknowthehowto achievelowcostproduct.

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