Design And Development Of Traffic Control Bollard System

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Abstract- *In the past decade and the current following years as the automotive industries took a spectacular boost, automobile were on the road causing long traffic. Various metropolitan cities are currently facing traffic issues and are finding ways to treat it better. The main problem causing traffic are the heavy loaded vehicles like trucks, trailers and public transport busses. As the public transport busses are essential parts of transportation and many people use this service as the better and reliable. Bollard are largely used for stopping or controlling of vehicular traffic and avoiding only a required or suppose vehicle which are permitted.As a public transport vehicle service some other emergency services like ambulance, fire brigade vehicle, police etc. needed rapid transportation so they can also use dedicated road of BRT in emergency condition.This project work focused the design and prototype modelling of automatic pneumatic bollard system suitable for above condition and easy to maintain traffic condition.*

Keywords- Design Bollard,System DesignAnalysis, Different symbols,Development Of Bollard System.

I. INTRODUCTION

The monitoring and control of city BRT traffic is becoming a major problem in India. The increasing number of vehicles and the lower phase of Highways developments have led to BRT traffic congestion problem especially in major Cities. Travel time, environment quality, life quality, and road safety are all adversely affected as a result of BRT traffic congestions. In addition, delays due to BRT barricade congestions also indirectly affect productivity, efficiency, and energy losses.

1.1 Problem Statement:-

Nowadays, the number of road users constantly increases; vehicle population also increased to an extreme level. So the traffic problem causes major time delay and more issues. So, we are in need to find better solution for traffic control.

1.2 BRT Public Trasport:-

BRT stands for bus rapid transit route system. The city of Pune was the first in India to experiment with a Bus Rapid Transit system. PMPML started plying pilot routes in December 2006.

1.3 Project Objective:-

To develop the project, there are two objectives that must be accomplished which are:-

i. Develop a new BRT traffic control system controlled by relay logic controller.
ii. Implement the system on a model of BRT traffic.

1.4 Future Scope:-

If these project is develop at the require location like entry and exit of BRT routs leads to dedicated corridor for BRT buses, restrict the entry of unauthorized vehicles from BRT roads. The main aim of the project is maintain BRT routes free from private vehicles, and providing open roads to bus drivers.

II. LITERATURE REVIEW

[1] Md. Abdul Aziz | Y.Naveen Kumar, "RFID Based Security and Access Control System using ARDUINO." International Journal for Modern Trends in Science and Technology (IJMTST) Volume: 2, Issue: 04, April 2016.With effective control the intersection, it is believed that the overall capacity and performance of urban BRT traffic network could be resolve. There are several types of conventional methods of BRT traffic control; however they fail to deal effectively with complex and time varying BRT traffic conditions.

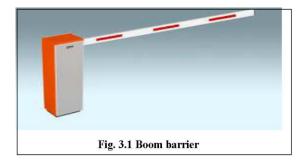[2]AGARWAL, P. K. "Performance Improvement of Urban Bus System: Issues And Solution." International Journal of Engineering Science and Technology Vol. 2(9), 2010. Arduino makes the circuit and programming a lot easier to understand. This project is based upon security access and control system using RFID and Arduino. Security access system is very convenient to use at army areas, refinery, bus

depot, DRDO office and commercial buildings. The advantage of the RFID system is contact-less and works `without line-of-sight. By using Arduino it is easy to access and works very quickly while burning the code it is like plug and play device. Users can change the function accordingly by using Arduino.

[3]Mr. Dhrubajyoti Adak, Manoj Kumar Pain stated that this paper is based upon security   contradict measures.The RFID technology did not stop at thing-level tagging. Since the uses for RFID tags are so extensive, there is a large interest in lowering the costs for production of RFID tags. It turns out that printing tags may become a possible alternative to traditional production. RFID tags : An RFID tag is a smooth card of credit-card size which is read by an RFID reader. It works at 125kHz and comes with a unique 32-bit ID. Normally, each tag has a unique ID number which cannot be changed. We can find out its unique ID through software. We used EM-18 RFID reader module which operates at 125kHz. The module comes with an on- chip antenna and can be powered with a 5V power supply. ARDUINO UNO BOARD: It is an open source electronics prototyping platform based on bendable, easy-to-employ hardware and software. It is proposed for artists, designer, hobbyists & anyone interested in generating various design for objects or environmental purpose. It is easier to use as the user simply needs to connect it to a computer with a USB cable or power it with an AC-to-DC.

III. BRIEFING ABOUT PRESENT SYSTEM

3.1 Automatic barricade

Boom Barrier is an automatic entrance and exit system which integrates boom barrier with photoelectric sensor. It is the simplest and most convenient solution to control traffic.

Fig. 3.1 Boom barrier

3.2Comparision of hydraulic and pneumatic system.

Sr. no.	Hydraulic system	Pneumatic system
1.	Working fluid is liquid	Working fluid is gas
2.	Work at very high pressure	Work at very low pressure
3.	Working fluid is incompressible	Working fluid is compressible
4.	Self lubricating effect	No self lubricatimg effect
5.	Return line is required for oil	No reverse oil hence any return line
6.	Frequent replacement of oil required	No need for fluid replenishment
7.	Heavy tubes or pipes needed.	Light tubing or pipe is sufficient

3.3 Basic principle of pneumatic system

It could be observed that the basic components involved are similar to a hydraulic system. The basic differences between hydraulic and pneumatic systems are that in hydraulic system the input mechanical energy is imparted to the oil is by pump, whereas, in pneumatic systems the working fluid being air, the mechanical energy is imparted to air by a compressor.
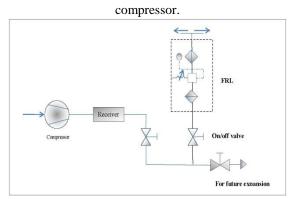

Fig..Layout of basic pneumatic system

Further, a hydraulic system usually operates at very high pressures to transmit the large force and power while a pneumatic system operates at low pressures of about 5 – 7 bar for industrial applications. Safety is of the utmost importance when handling compressed air. If compressed air enters the body it can kill. Never use your finger to detect if compressed air is present, and always keep compressed air away from your eyes, nose, mouth etc. As well as direct danger from the compressed air, pneumatic pistons can move quickly and with a great deal of force, so always be careful to keep fingers etc. away from live pneumatic systems. When connecting pneumatic circuits, make sure that all connections are secure before finally connecting your circuit to the compressed air supply.

IV. DESCRIPTION OF EQUIPMENT AND OPERATION

In this system the number of equipments are used for better and quick operation
.

4.1 Limit Switches**.**

A mechanical limit switch interlocks a mechanical motion or position with an electrical circuit. A good starting point for limit-switch selection is contact arrangement. The most common limit switch is the single-pole contact block with one NO and one NC set of contacts; however, limit switches are available with up to four poles.Limit switches also are available with time-delayed contact transfer. This type is useful in detecting jams that cause the limit switch to remain actuated beyond a predetermined time interval. Other limit switch contact arrangements include neutral-position and two-step. Limit switches feature a neutral-position or center-off type transfers one set of contacts with movement of the lever in one direction. Lever movement in the opposite direction transfers the other set of contacts. Limit switches with a two-step arrangement, a small movement of the lever transfers one set of contacts, and further lever movement in the same direction transfers the other set of contacts. Maintained-contact limit switches require a second definite reset motion. These limit switches are primarily used with reciprocating actuators, or where position memory or manual reset is required. Spring-return limit switches automatically reset when actuating force is removed.

4.2 Solenoid Valve

A solenoid valve is a combinationof twofunctional units. A solenoid operator essentially consisting of a coil, core, core tube, shading coil and spring. A valve body containing orifices in which a disc, diaphragm or piston etc .is positioned according to the type of technology used. The valve is opened or closed by movement of the magnetic core which is drawn into a solenoid when the coil is energized.
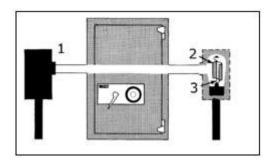
4.3 Electronic Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

4.4 Photoelectric Sensor

A photoelectric sensor, or photo eye, is a device used to detect the distance, absence, or presence of an object by using a light transmitter, often infrared, and a photoelectric receiver. They are used extensively in industrial manufacturing. There are three different functional types: opposed (through beam), retro-reflective, and proximity-sensing (diffused). Conceptual through-beam system to detect unauthorized access to a secure door. If the beam is broken, the detector triggers some remote alerting device.

4.5 Basic Frame.

This project, automatic barricade system, is a demonstration model.. Basic frame is formed by mild steel angle and the complete unit is fitted on the fame. Seat is made of sheet metal of gauge 18.

4.5Working operation

Compressed air is used as force medium of this project operation. This compressed air can be easily taken from the air cylinder of the barricade system.The control unit consists of a relay circuit. It is an electromagnetic switch. It has two outputs. The solenoid valve unit consists of two ½ solenoid valves. ½ indicates two ports and one way operation. Compressed air enters through first solenoid valve and expelled to atmosphere through second solenoid valve. Air enters to barricade chamber through connection provided between these two solenoid valves. When driver is in the seat, barricade is not needed. At that time, the limit switch is in open mode. Photo voltaic sensor since between BRT bus and barricade senser current can passes to relay circuit through the switch.realy is on position barricade open with help of mechanical linkage but any sudden condition any other vehicle passed with BRT these time limit switch is on and barricade is not open to another damage to barricade limit switch senses and send electric current to relay circuit. One of

the relay output sends out a voltage to first solenoid valve and now it is in opened position so the compressed air enters to chamber

V. CAD MODEL

Fig..Design of project model

Basic component will be used

1. Air compressor
2. Pneumatic cylinder
3. Two way direction control valve
4. Solenoid valve
5. Relay
6. Controller (Arduino)
7. RFID controller & Tag
8. Emergency switch.

5.1 Pneumatic cylinder

Fig.. Pneumatic cylinder

Pneumatic cylinder are mechanical device which use the power of compressed gas to produce a force in a reciprocating linear motion. Double-acting cylinders use the force of air to move in both extend and retract strokes. They have two ports to allow air in, one for outstroke and one for in stroke.

5.2 Air Compressor

Fig..Air Compressor.

A gas compressor is a mechanical device that increases the pressure of a gas by reducing its volume. Compressors are similar to pumps both increase the pressure on a fluid and both can transport the fluid through a pipe. As gases are compressible, the compressor also reduces the volume of a gas. Liquids are relatively incompressible, while some can be compressed, the main action of a pump is to pressurize and transport liquids. Compressor is used for generating pressure in pneumatic system. Minimum pressure is required for pneumatic system is about 1bar. Pneumatic air is passed through the houses from the compressor outlet to the inlet of direction control valve. Floe control valve is used to moderate pressure in the system.

5.3 Cushioning

Cushioning is imperative to absorb the kinetic energy of the piston as it reaches the end of the stroke and prevent harmful shocks. It is achieved by some form of damping or retarding device. Spring can be used to provide the cushioning effect but different cylinder operating speeds necessitate different spring designs. When the springs are used accommodation becomes a problem as cylinder length gets increased. Back pressure also provides a cushioning effect in pneumatic cylinder. When the boss reaches the recess at the cylinder and the cushion chamber is formed and the back pressure consequently provides the damping action. Here the length of the stroke through which the damping takes place at the peak to which the pressure is to be allowed to rise during the damping period, they are important factors. It may be noted that too long and short clamping period, which with respect to the stroke time, are both not favorable. Further the cushioning action may be achieved either internal or external means. In the former type, air is trapped by the nose section of the piston to form the cushion chamber at the cylinder and whereby kinetic energy is converted into heat. However, internal cushioning is not advisable for high piston speed as the operation becomes sluggish and general service conditions.

5.4 Two way directional control valve. Direction control valve perform only three function

• To stop the fluid flow
• To allow the fluid flow
• To change the direction of fluid flow.

These three function are usually operated in combination .There are two main types of valves used in pneumatic switching circuits. The 3/2 valve and the 5/2 valve. The 3/2 valve is used to control items such as single acting cylinder which have a single input. The input to the cylinder is connected to the port2, the air supply to port1 and port 3 is allowed to exhaust to atmosphere. The number 3 signifies that valve has three ports, while number 2 signifies that the valve has two positions. The 5/2 valve is used to control items such as double acting cylinder which has two inputs .The inputs to the cylinders are connected to ports 2and 4,the air supply is to port 1.Port 3 and 5 are allowed to exhaust to the atmosphere. The no 5 signifies that the valve has 5 ports, while the number 2 signifies that a valve has two directions or states.

5.5 Solenoid Valve

Fig..Solenoid Valve.

To change the direction of airflow to and from the cylinder, we use a directional Control valve. The moving part in a directional control valve will connect and disconnect internal flow passages within the valve body. This action results in a control of airflow direction. The typical directional control valve consists of a valve body with four internal flow passages within the valve body and a sliding spool.

5.6 Hoses

The function of the piping in either a hydraulic or a pneumatic system is to act as a leak proof carrier of the fluid Steel pipes are normally used for air mains. For braid pipes or smaller lines up to about 25 mm. Bore copper piping nylon tubing is commonly employed with flexible lines at the takeoff points. Flexible nylon tubes may be used directly for smaller diameter house or reinforced with braid for larger. Rubber house is used for flexible lines where a wide working

temperature is required or larger size is needed. Plain (uncomforted) polythene tubing is more flexible than nylon tubing. Typical maximum pressure rating 7 bars for 15 mm O.D. tubing is not for rigid installations except where adequate support by pipe clips can be arranged.

VI. DESIGN OF PNEUMATIC COMPONENTS

Data: Material= Al
Tensile strength ( )= 200 N/$mm2$
Pressure (P) = 3 bar = 0.3 N/$mm2$
Poisons ratio (μ) = 0.36
Inner radius ( ) = 25 mm

As per the available data we can calculate the thickness of cylinder using Clavarino's equation.

Clavarino's equation

$t = ri$ [$\sqrt{\sigma t}$+ (1− 2μ) Pσt− (1+ μ) P−1].
 Rankine's formula,
σt= $\sigma ut FOS$
  Here,   = tensile strength of aluminium
σut = Ultimate tensile strength
       FOS = factor of safety.
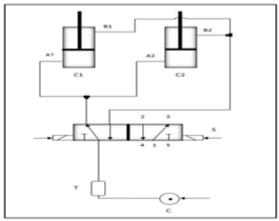
6.1 Pneumatic Circuit

Fig.. Pneumatic Circuit

C = compressor
T = air receiving tank
S = Solenoid valve with 5/2 DCV
C1 & C2 = Cylinder 1&2
A1 & A2 = Inlet of Cylinder C1 and C2
B1 & B2 = outlet of cylinder C1 and C2Pneumatic circuit operated on 5/2 direction control valve control by solenoid valve. Two cylinder operated at time is a hydraulic pressure around 1-3 bar supplied from compressor tank. 5/2 direction control valve as two position for extraction and retraction.

Direction control valve is provided with 5 ports as shown in figure the port 1 connected with compressed air from tank where port 2 and 3 is outlet port from directional control valve and connected with cylinder through pneumatic hoses, carrying compressed air to the inlet of the cylinder and return back from cylinder outlet to the direction control valve. The remaining port 4 and 5 is open to the atmosphere When direction control valve is in 1 position compressed air from compressor to the port 1-2 carrying air to the cylinder inlet A1 and A2. The air flow is split equally by using T joint in pressure line as well as return line hence both the cylinder operated at same condition when pressure is rising the movement of piston applied pressure other side of piston rod the air present at the other side of piston rod moves through outlet B1 and B2. Outlet from return line passes through the port 3 and 4 of direction control valve

Similarly is second position of direction control valve piston at extracted position is return back by changing the direction control valve, and operation of retraction is a vice versa of position one.

VII. ADVANTAGES

- Any other system needs a manual operation.
- Barricade has complicated electronic control, where as automatic has simple electronic   control unit.
- Presence of emergency switch to compensate with emergency situation.
- Need less electric current than power system.
- Absence of mechanical linkages.

VII. CONCLUSION.

The improvement of town traffic condition is largely depend on modern ways of traffic management and control. Advance traffic signal controllres and control system contribute to the improvement of the traffic problem. The intelligent of traffic signal is introduced in this project has two major phase. The first stage is to design program which consist of reading research planning and designing a problem. Design a traffic light using state machine is very difficult compare to design using the logic gates.

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