AUTOMATIC OPENING OF EMERGENCY WINDOW BY MAGNETIC RELEASE MECHANISM

DINESH, RAMACHANDRAN
Thiagarajar College of Engineering
INDIA

KARTHIK, RAVISHANKAR
St. Joseph's College Of Engineering
INDIA

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ABSTRACT
The main objective is to facilitate quicker and safer evacuation of passengers in case of frontal and rear impact of bus by automatic opening of emergency windows. The integrated magnetic release mechanism controlled by various sensors like piezo sensor, accelerometer sensor, temperature sensor and poison gas sensor installed at various locations inside the bus, helps in releasing the emergency windows during an impact. This reduces the time the passenger takes to exile the bus as the need for break opening of the windows is avoided. This system also facilitates increased number of exit points for the passengers by changing all windows into exit windows. At normal situations, the metal beaded windows are held firmly in position by the magnet, whereas during impact it releases the windows without damaging them which increases the longevity of the system.

INTRODUCTION
The present system of emergency exit consists of a breakable window with a provision of a hammer. However during impact the because of sudden G-force change and Post-Traumatic Stress Disorder, the normal human response time increases. This delay increases the time taken to come out of the bus which can dangerous in case of accidents involving fire or those involving spreading of poisonous gases. This can be reduced by using the proposed system

Figure 1: emergency window with hammer to break open

The proposed system consists of metal beaded windows, Piezo sensors, accelerometer sensor, poison gas detector and temperature sensor. These sensors when activated, sends signal which is used to drive the servo motor. The servo motor turns the diametrically magnetized cylindrical permanent magnet. This changes the magnetic field, causing the emergency windows to open. This is advantageous because in case of minor incident, then we can override the system and close the windows and operate the bus.

BACKGROUND

Magnetic Setup consists of a permanent cylindrical diametrically magnetized neodymium magnet. It is installed similar to a magnetic V- block (shown in *fig 2).*

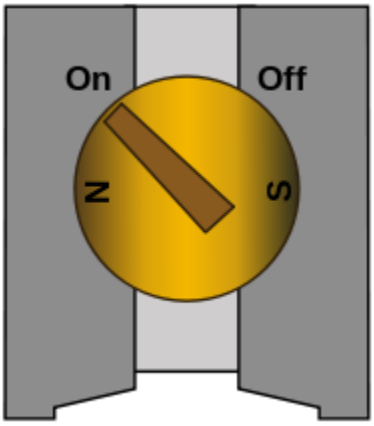

Figure 2: Magnetic V-block

The center permanent magnet, due to its field strength holds the metal piece firmly in its position. The magnetic strength of the permanent magnet on the metal strip at a distance is given by

$B_r (r, Ø) = \mu_o * M * a^2 * \cos (Ø) / 2 * r^2$
$B_Ø (r, Ø) = \mu_o * M * a^2 * \sin (Ø) / 2 * r^2$

Where,
M= magnetization of the magnet
r and Ø are cylindrical coordinates of the metal strip from poles of the magnet

From above equations, the magnetic strength is inversely proportional to the square of distance of the magnet, when the magnet is turned away using a servo motor, the distance of the poles from metal strip increases therefore causing the strength to decrease, thus resulting in opening of the windows.

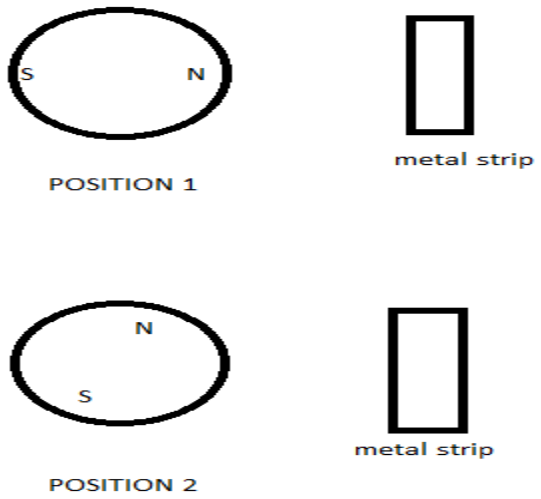

Figure 3: Positions of the magnet

The position 1 (in figure 3) shows the position of the magnet during normal working conditions of the bus. Position 2 shows the magnet being displaced by a motor which results in opening of the windows.

The Poison Gas Detector is installed inside the bus and it send signal to the central ECU when the gas concentration crosses the maximum ppm range tolerable by humans.

Accelerometer sensor detects the vibration level of the bus structure. During an event of accident where the structure undergoes vibration above the particular the standard WBV (whole Body Vibration), Then it send signal to the ECU. Also the Piezo sensors installed at various locations on the bus when impacted will send signal to the ECU.

Temperature Sensor monitors the temperature inside the bus and when it detects a sudden rise in temperature above the desirable limits, it send signal to the ECU.

Electronic Control Unit receives signal from sensors installed at different locations on the bus. When signal comes from the sensors, it activates the warning indicator present in the display unit present near to the driver and it also controls the servo motor to rotate the cylindrical magnet away from the metal strip (90^{o}).

The overall schemtic layout of the emergency system is shown in *figur 4*

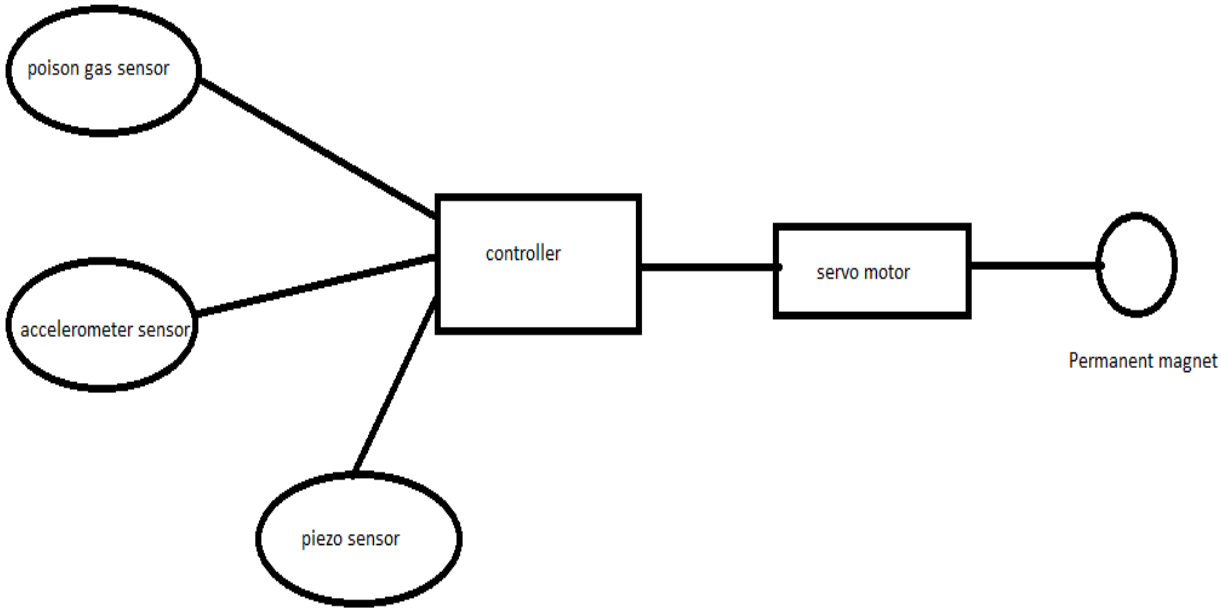

Figure 4: Schematic Representation of the system

CONCLUSION AND RECOMMENDATION

The proposed system can help in quicker evacuation of the passengers because of reducing the time required to open the emergency windows, in case of frontal impact, rear impact and fire accidents. Due to the increasing the number of accidents[1] involving buses, the need to improve the safety features of the existing buses is an ultimate requirement.
However the proposed system doesn't provide any advantage over the current system in case of rollovers.

1: Asia-Pacific road accident statistics

REFERENCES:

1: Edward P. Furlani. “Permanent magnet and electromechanical devices”

2: Dr. Matolacsy, Matyas. “New requirement to emergency exit of buses”

3: Whole body vibration Fact sheet.