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FABRICATION OF AUTOMATIC EMERGENCY EXIT FOR SCHOOL BUS

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Abstract : This project's goal is to use a vibration sensor to open the bus' emergency exit. An important addition to help passengers in an accident escape and be saved is an emergency exit door. Emergency escape systems for automobiles employ sensors, thus every automobile has a unique vibration sensor that sends the signal to open the emergency exit door. Buses use limit switches and motors to open their emergency exit doors. Release the door automatically if the vehicle is in an accident.

INTRODUCTION

The automatic emergency exit system makes use of contemporary technologies to improve the efficiency and safety of emergency evacuations. In order to recognise emergency situations and enable the quick opening of emergency exits, it integrates sensors, actuators, and sophisticated control systems. This development intends to reduce potential risks and raise the general bar for school bus safety. To address this concern, the fabrication of an automatic emergency exit system for school buses has been developed.

For both parents and schools, the safety of pupils while they are being transported is of the utmost importance. In order to ensure that students are transported safely to and from educational facilities, it is imperative that school buses include cutting-edge safety features. The availability of emergency exits that can be quickly used in the case of an emergency, such as a fire or accident, is a crucial component of school bus safety.Emergency exits on conventional school buses are normally manually operated and need a person to open them. However, in some circumstances, panic or bewilderment may prevent the inhabitants, particularly young children, from using these escapes.

NEED OF THE STUDY.

The construction of a school bus automated emergency exit system is a challenging process that necessitates a deep comprehension of numerous technical and safety considerations. The following topics might be studied to help create a dependable and effective automatic emergency evacuation system: School Bus Safety Standards: It's critical to have a thorough awareness of the rules and safety requirements that apply to using school buses. This information is essential for ensuring that the constructed system complies with all applicable safety regulations and standards.Studying emergency response systems can aid in determining the crucial elements needed for the automatic emergency escape system. The design and development of the automatic emergency exit system can benefit from knowledge of emergency response protocols, evacuation processes, and rescue operations.

Sensor technologies: Sensor technologies are essential to the automatic emergency exit system's functionality. A study of the various sensor types, their precision, and their use in emergency situations might help in choosing the right sensors for the system. Actuator technologies: When an emergency scenario is discovered, actuators are in charge of opening the emergency exits. The choice process can be guided by research into various actuator technologies, including their responsiveness, dependability, and compatibility with the selected sensors

.3.1 COMPONENT THEORY

The theory underlying the components employed in this work, from their fundamental modes of functioning to their utilisation in this research endeavour, is described and explained in this subsection. Dc motor, vibration sensor, photo diode, transistor, IC timer, 4 comparators, logic control, seven segment decoders, seven segment display, micro controller, relays, and other passive components are among the components utilised.

3.2 MACHINE COMPONENTS:

The FABRICATION OF AUTOMATIC EMERGENCY EXIT FOR SCHOOL BUS consists of the following components to full fill the requirements of complete operation of the machine.

1. Motor
2. Wheel
3. Battery
4. Arduino

RESEARCH METHODOLOGY

The methodology section outline the plan and method that how the study is conducted The information-gathering, design, development, and system validation phases of the research methodology for the manufacturing of an automatic emergency exit for a school bus entail a systematic approach.

3.1 CONSTRUCTION AND OPERATION

components included inside a micro switch From left to right, contacts are categorised as common, normally open, and normally closed.Two springs are contained within a micro switch. Both carry the electrical current that powers the switch.A long flat spring with electrical connections is hinged at one end (the left end in the illustration) and is flat on the other. The small curved spring is preloaded (i.e., compressed during assembly) and connected to the flat spring so that it seeks to extend itself (at the top, just to the right of centre in the picture) close to the contacts. The centre of the flat spring is near a fulcrum. An actuator nub rubs against the flat spring close to its hinge point.Since the flat spring is attached and strongly tensioned, the curved spring is unable to move it to the right. The curved spring exerts pressure on the flat spring by pulling it or pushing it upward and away from the anchor point. The geometry causes the upward force to increase proportionately as the flat spring moves downhill, while the displacement decreases. (In fact, at small angles, the force is inversely proportional to the sine of the angle, which is inversely proportional to the angle.)

As the actuator depresses, the flat spring flexes, maintaining contact between the electrical connections and the curved spring. Once the flat spring has flexed enough to provide enough force to compress the curved spring, the contacts will begin to move.The motion increases even in the absence of additional actuator motion as the flat spring lowers and eventually makes contact with the normally-open contact. This is due to a decrease in the upward force of the curved spring as the flat spring falls. Even though the flat spring loses flexibility as it descends, the switch is designed to accelerate total motion. This "over-center" motion results in a sharp feeling and a very distinct clicking sound. While it is in the activated state, the bent spring pulls upward in some measure. If you release the actuator, the flat spring will rise. As the flat spring moves, the bent spring's force increases. This results in acceleration before to striking the typically closed contacts. The switch is constructed similarly to the downhill direction such that even if the flat spring must bend during the switchover because the actuator is immobile, the curved spring will still have enough force to move the contacts.

3.2 THE ELECTROMAGNETIC RELAY

The electromagnetic relay is a multi-turn coil that has been wound around an iron core to form an electromagnet. When a coil is triggered by having electricity flow through it, the core of the coil temporarily becomes magnetised. To the magnetised core is attracted the iron armature. The armature's angular movement controls one or more sets of contacts. Coil de-energization releases the armature and connections. A low power source, such as a transistor, may power the coil while the contacts may switch high powers like the mains supply. Relay placement options also include placing it far from the control source. Relays have the capacity to generate an incredibly high voltage across the coil when they are turned off. As a result, other circuit components can sustain damage. A diode is wired across the coil to stop this. The coil's most positive end is wired to the cathode of the diode.

The springsets (contacts) may include both n.o n.c. and c.o. contacts. To learn how switches can be utilised in circuits, visit the switches page. There are different coil operating voltages (both ac and dc) available. Both high current and low current operation are possible using the real contact locations on the springsets. Compared to the relays mentioned above, the RED RELAY operates substantially faster. A high power motor is regulated by a low voltage relay in the circuit above. The relay is turned on and the 12-volt circuit is finished when the "start" button is pressed. The motor receives 240 volts when the three sets of connections close. The motor will continue to run even after the "start" switch is removed because it is now linked to a closed relay contact. The relay has "latched on" to it. The 12 volt circuit is cut off by pressing the "stop" button. The relay loses power as the motor turns off

3.3 DC MOTORS

The d.c generators and d.c motors have the same general construction. The motor principle is : An electric motor is a machine which converts an electrical energy to mechanical energy.

All D.C machines have five principal components viz

(i) Field system

(ii) Armature core

(iii) Armature winding

(iv) Commutator

(v) Brushes

(vi) Field system

The field system's purpose is to provide a uniform field in which the armature revolves.It consists of a number of prominent poles—always an even number—bolted to the interior of a circle-shaped frame, or "yoke."The pole component is typically built of stacked laminations, while the yoke is typically made of solid cast steel. The d.c stimulating current is carried by field coils that are installed on the poles. The field coils are linked together so that adjacent poles are polarised in the opposite direction. A magnetic flux that travels through the pole pieces, the air gap, the armature, and the frame is created by the coils' produced m.m.f. Air gaps in actual DC machines range from 0.5 to 1.5 millimetres.The majority of the m.m.f. of field coils is needed to create flux in the air gap since armature and field systems are made of permeability-based materials. We can decrease the size of field coils (number of turns) by reducing the length of the air gap.

(vii) Armature core:

The armature core spins between the field poles and is keyed to the machine shaft. It is constructed of stacked, cylinder-shaped slotted soft-iron laminations with thicknesses varying from 0.4 to 0.6 mm. A thin insulating coating is placed to each of the laminations to avoid electrical contact between them. Eddy current loss is decreased as a result of the core being laminated. The laminations have slots so that the armature can be wound and be mechanically secure. Additionally, they have slots such that there is a smaller air gap between the pole face and the armature "teeth" for flux to travel through.

(viii) Armature winding:

Properly connected conductors are maintained in place in the slots of the armature core. This operation is known as armature winding. A "working" electromagnetic field is induced in this winding. The conductors in the armature are linked together in series and parallel, with the series connection increasing voltage and the parallel connection increasing current .The armature of a direct current (DC) machine uses a closed-circuit winding to produce a closed loop or series of closed loops.

(ix) commutator;

A commutator, a mechanical rectifier, transforms the alternating voltage in the armature winding into direct voltage across the brushes.The commutator, which is mounted on the machine's shaft, is made of mica sheets and copper segments that are spaced apart from one another. The armature conductors are properly linked to the commutatorsegments to form the armature winding.In an a.d.c. machine, the armature can be wound in one of two ways: (a) lap winding, or (b) wave winding. These depend on the configuration of the commutator segment connections to the armature conductors. The commutator is built with great care because any flaw could cause the brushes to bounce, producing loud sparking that is intolerable.Sparks could lead to an overheated commutator that burns the brushes and carbonises.

(x) Brushes:

The purpose of brushes is to maintain electrical connections between the rotating commutator and the stationary external load circuit. The carbon brushes have adjustable springs that regulate the brush pressure, and they rest on the commutator. If the brush pressure is really high, the commutator and the brakes will become hot.On the other hand, if it is too weak, improper contact with the commutator may lead to sparking.

3.4 STATOR:

The component of an electric generator or electric motor that is stationary is called the stator. The rotor is the non-stationary component of an electric motor.Depending on how it is configured, the stator of a rotating electromotive device can either serve as the armature or the field magnet, interacting with the rotating field coils of the rotor to produce motion.

In early DC motors and generators, the field coils are mounted on the stator, while the power-generating or motive reaction coils are mounted on the rotor. This was crucial since the field's exact alignment across the rotating rotor is maintained by the commutator, a continuously rotating power switch.As the current rises, the commutator must grow bigger and more durable.These devices' stators can either be electromagnets or permanent magnets. The coil that energises the stator when it is an electromagnet is referred to as the field coil or field winding

3.5 ROTOR

An electric rotary motor or alternator's rotor, which is its moving part, rotates as a result of the positioning of the motor's wires and magnetic field, which produce a torque around the rotor's axis. It is possible for the rotor to serve as the motor's armature in some designs, giving the input voltage to the motor's windings.

3.6 BATTERY

Electrodes (Plates): Plate construction is the key to making a good battery. In acknowledgement of this, Power-Sonic uses the most modern equipment and techniques to cast grids from a lead-calcium alloy that is free of antimony. The grid alloy's small concentrations of tin and calcium give the plate strength and guarantee durability even after numerous cycles of use. Lead oxide paste is injected into the grid to produce the electrically active material. Lead oxide makes up the paste of the positive plate while pure lead in its charged condition makes up the paste of the negative plate. Both of these have a porous or spongy form to increase surface area and hence capacity.

Separators: Power-Sonic separators are made of woven glass fiber cloth with high heat and oxidation resistance. The material further offers superior electrolyte absorption and retaining ability, as well as excellent ion conductivity.

Electrolyte: Immobilized dilute sulfuric acid: H_2SO_4.

Container :Case material is either ABS, a high-impact proof plastic resin, styrene, or a polypropylene-polyethylene copolymer with resistance to chemicals and flammability.

Leak-proof Design & Operational Safety: Power-Sonic batteries have been approved for shipment by air, both by D.O.T. and I.A.T.A.. U.L.'s component recognition program for emergency lighting and power batteries lists Power-Sonic under file numbers MH14328and MH14838.

Terminals : AMP Fast on type terminals made of tin-plated brass, post type terminals of the same composition with threaded nut and bolt hardware, or heavy duty flag terminals made of lead alloy are all options for battery terminals, depending on the model. The sealing material used around the terminals is a special epoxy.

Relief Valve: If there is an excessive accumulation of gas pressure inside the battery, which is often caused by irregular charging, the relief valve will open and release pressure. In the event of significant overcharging, the one-way valve acts as a crucial safety feature by preventing air from entering the battery, where the oxygen would react with the plates and result in internal discharge. The vent release pressure ranges from 2 to 6 psi, and the seal ring is made of neoprene rubber.

case sealing: Depending on the model, polyurethane, epoxy, or heat seal is used for the case sealing.

3.7 SCREW ROD

A threaded rod, also known as a stud, is a relatively long rod that is threaded on both ends; the thread may extend along the complete length of the rod.They are designed to be used intension.Threaded rod in bar stock form is often called all-thread.

There are two sorts of studs for those that are not entirely threaded: full-bodied studs and undercut studs. The shank of full-bodied studs is the same size as the thread's main diameter. The shank of undercut studs is the same diameter as the pitch of the screw thread. Axial stresses are better distributed by undercut studs. The threads of a full-bodied stud are under more tension than the shank is.

Because the metal is "rolled" up to the primary diameter rather than being removed, undercut studs (rolled thread) are also stronger. This keeps the steel's grain intact and, in certain circumstances, even improves it. Due to the removal of metal to make the thread and the resulting disruption of the steel's grain, full bodied studs (cut thread) are weaker.

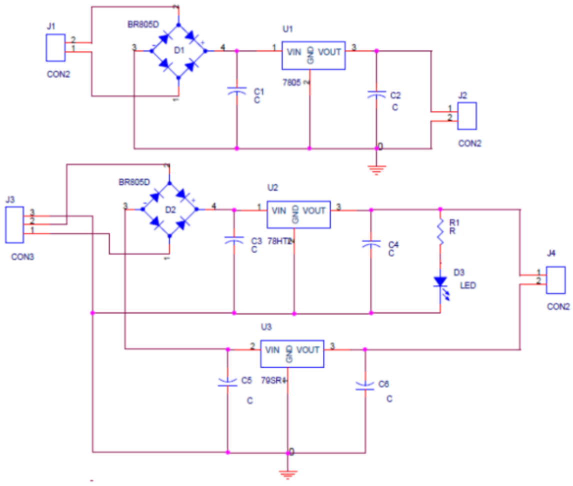
Undercut studs are only required in applications where the stud is exposed to fatigue. Cut threads are entirely suitable for many applications, even when rolled threads might be slightly stronger. Mass-produced fasteners (standard bolts and studs) are usually rolled, but jobbed parts with custom features and small lot sizes are likely to be cut.

A screw is a mechanism that converts rotational motion to linear motion, and a torque (rotational force) to a linear force. [1]It is one of the six classical simple machines. The most common form consists of a cylindrical shaft with helical grooves or ridges called threads around the outside. The screw passes through a hole in another object or medium, with threads on the inside of the hole that mesh with the screw's threads. When the shaft of the screw is rotated relative to the stationary threads, the screw moves along its axis relative to the medium surrounding it; for example rotating a wood screw forces it into wood. In screw mechanisms, either the screw shaft can rotate through a threaded hole in a stationary object, or a threaded collar such as a nut can rotate around a stationary screw shaft. Geometrically, a screw can be viewed as a narrow inclined plane wrapped around a cylinder.

Like other simple machines, a screw can increase force; a small spinning force (torque) on the shaft can impose a substantial axial force on a load. With a reduction in screw pitch, or the distance between the threads, the mechanical advantage—the ratio of the output force to the input force—increases. In addition to threaded fasteners, screws are frequently employed in machinery like vises, screw jacks, and screw presses to hold things together.
Other devices with the same operating principle, often known as screws, don't always have a shaft or threads. An Archimedes' screw is a water pump that uses a spinning helical chamber to propel water uphill, while a corkscrew is a helix-shaped rod with a sharp end. The common principle of all screws is that a rotating helix can cause linear motion.

3.8 POWER SUPPLY

The term "power supply" refers to an electrical power source. An output load or group of loads is supplied with electrical or other types of energy by a power supply unit, which is a device or system. The phrase is most often used in relation to electrical energy sources, although it is also occasionally used in relation to mechanical and other energy sources.This typically involves converting 240 volt AC supplied by a utility company to a well-regulated lower voltage (+/-12V) DC for electronic devices.



Normal ac voltage, which is 220V rms, is scaled down by a transformer to the level of the desired dc output. A simple capacitor filter first filters the signal to produce a dc voltage, and a diode rectifier next produces a full-wave rectified voltage. Typically, the resulting dc voltage has some ripple or ac voltage shift.

A regulator circuit eliminates the ripples and keeps the output dc value constant, regardless of changes in the load connected to the output dc voltage or in the input dc voltage. Usually, one of the well-liked voltage regulator IC chips is utilised for this voltage regulating.

3.9 Transformer

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

3.10 Bridge rectifier

The circuit is known as a bridge rectifier when four diodes are linked as in the figure. The network's diagonally opposed corners serve as the circuit's input, and the remaining two corners serve as the network's output. Assume that the transformer is in good working order and that points A and B have positive and negative potentials, respectively. With point A's positive potential, D3 will be skewed forward, and D4 will be skewed backward.

Point B's negative potential will cause D1 and D2 to move in the opposite direction. D3 and D1 are currently forward biassed, allowing current to flow through them; D4 and D2 are reverse biassed, preventing current flow. The secondary of the transformer serves as the conduit for current flow, which travels from point B through D1, up through RL, through D3, and back to point B. The solid arrows point in this direction. Across D1 and D3, waveforms (1) and (2) can be seen.

A half cycle later, the polarity across the transformer's secondary reverses, driving D2 and D4 in one direction while driving D1 and D3 in the opposite direction. The direction of current flow will now be through point A, D4, RL, D2, the secondary of T1, and back to point A. The broken arrows point towards the direction of this path. Across D2 and D4, waveforms (3) and (4) can be seen. The direction of the current flow via RL is constant. This current generates a voltage that corresponds to the waveform (5) depicted when it passes through RL. This bridge rectifier is a full-wave rectifier because current flows through the load (RL) during both half cycles of the supplied voltage.

The fact that a bridge rectifier produces an output voltage that is nearly twice as high as a traditional full-wave circuit with a given transformer is one benefit it has over the former. Assigning values to a few of the parts in views A and B can demonstrate this. Assume that the transformer is the same in both circuits. In both circuits, the peak voltage that develops between points X and Y is 1000 volts. The peak voltage from the centre tap to either X or Y in the typical full-wave circuit seen in view A is 500 volts. The greatest voltage that can be rectified at any time is 500 volts because only one diode can conduct at a time.

Due to the minimal voltage drop over the diode, the maximum voltage that can be seen across the load resistor is almost 500 volts, but it never goes above that level. The full secondary voltage, or 1000 volts, is the highest value that can be rectified in the bridge rectifier depicted in view B. As a result, there is almost 1000 volts of peak output voltage across the load resistor. The bridge rectifier circuit generates a higher output voltage than the traditional full-wave rectifier circuit when the same transformer is used in both circuits.

3.11 IC voltage regulators

A class of frequently used ICs includes voltage regulators. The circuitry for the reference source, comparator amplifier, control device, and overload protection are all combined in a single IC in regulator IC units. A fixed positive voltage, a fixed negative voltage, or an adjustable set voltage can all be regulated by IC devices. The regulators can operate with load currents ranging from hundreds of milliamps to tens of amps, which corresponds to power ratings of milliwatts to tens of watts.

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground. The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

- For ICs, microcontroller, LCD --------- 5 volts
- For alarm circuit, op-amp, relay circuits ---------- 12 volts

3.12 MILD STEEL

The most popular type of steel is mild steel, commonly referred to as plain-carbon steel, because it is more affordable than iron while still offering material qualities that are suitable for a wide range of uses. Low-carbon steel is malleable and ductile because it has between 0.05 and 0.320% carbon. Mild steel is inexpensive and malleable despite having a relatively low tensile strength; carburizing can raise the surface hardness. When substantial amounts of steel are required, such as for structural purposes, it is frequently used. Mild steel has a density of about 7.85 g/cm3 (7850 kg/m3 or 0.284 lb/in3) and a Young's modulus of about 210 GPa (30,000,000 psi).

Where the material has two yield points, low-carbon steels experience yield-point run out. The yield reduces significantly after the upper yield point and is higher at the initial yield point (also known as the upper yield point). A low-carbon steel's surface may develop Lüder bands if it is only stressed up to a point halfway between the upper and lower yield point. Low-carbon steels are simpler to work with because they have less carbon than other steels and can be formed more easily in the cold. One of the most widely used building materials is mild steel. It may be created from easily accessible natural materials and is incredibly durable. Due to its comparatively low carbon content, it is referred to as mild steel.

Mild steel typically has a maximum of 40 carbon points. One carbon point equals.01 percent of the steel's carbon content. This indicates that the carbon content is only.4% at most. In order to provide most steels particular desirable mechanical qualities, alloying elements other than carbon are typically used. Common mild steel 1018 has a manganese content ranging from.6 to.9 percent, a phosphorus content of up to.04 percent, and a sulphur content of up to.05 percent. These compounds can be changed to change characteristics like strength and resistance to corrosion. Mild steel has a very low carbon content, which makes it exceptionally robust. Strength is a challenging concept in materials science. The resistance of mild steel to breaking is very great.

Compared to steels with a higher carbon content, mild steel is quite bendable even when it's cold. This indicates that it has a high impact and tensile strength. Under stress, higher carbon steels typically shatter or crack, whereas mild steel bends or deforms. Due to its weldability and machinability, mild steel is particularly preferred for construction. It is quite soft due to its great strength and malleability. Compared to harder steels, this indicates that it can be machined more easily. Additionally, it is simple to weld to itself and to other kinds of steel. It polishes up nicely and acquires a lovely sheen. However, unlike higher carbon steels, it cannot be toughened through heat treatment procedures.. This is not entirely a bad thing, because harder steels are not as strong, making them a poor choice for construction projects.

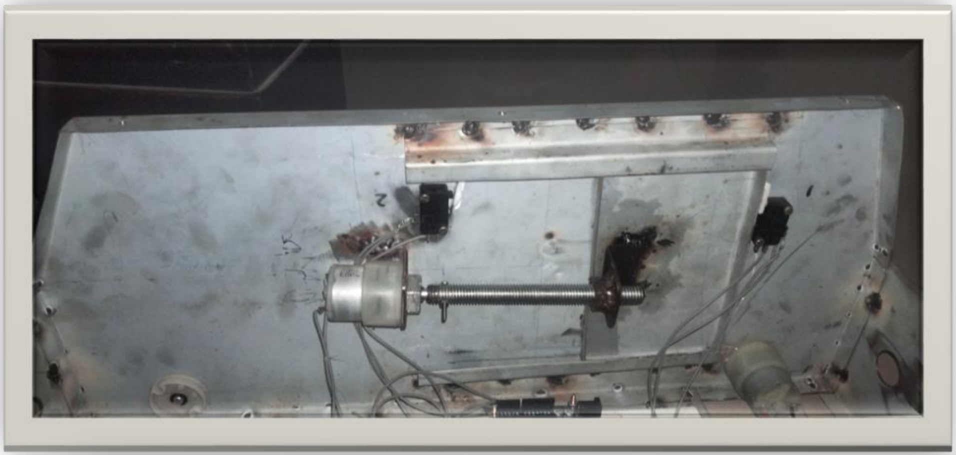
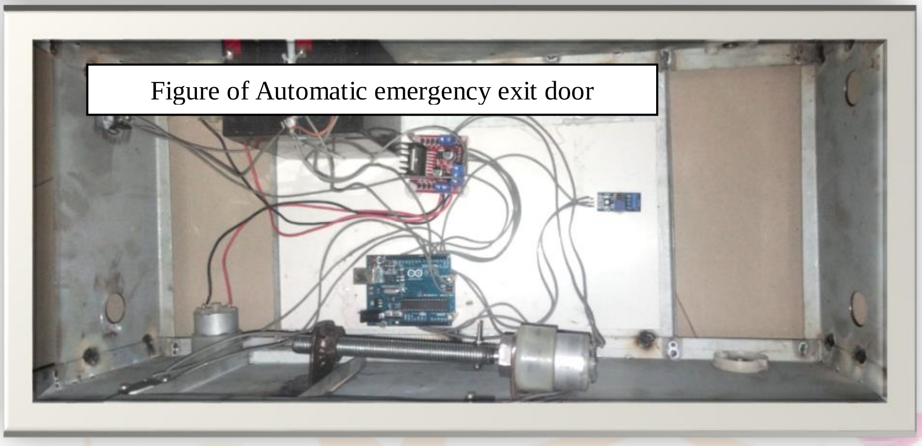


Figure of Automatic emergency exit door



IV. RESULTS AND DISCUSSION

The construction of an automatic emergency exit for a school bus would entail creating and putting into action a system that enables the speedy and secure evacuation of passengers in the event of an emergency. I am unable to provide you with details regarding the most recent advancements in this field, but I can give you some broad ideas and potential features for such a system:

Emergency Release Mechanism: The system needs a way for users to swiftly and conveniently access the emergency exit from the inside. That which activates the openir

Construction of Automatic emergency exit door

Quick Deployment: The emergency exit needs to be built to open quickly so that people may get off the bus quickly. It should reduce any barriers or dangers that might stand in the way of the evacuation procedure.

Safety features: To prevent unintentionally activating the emergency exit while the bus is moving, the system should include safety measures. This might involve sensors that track the bus's movements or speed and only enable the exit when it is stationary.

Alarm and Signaling: The system could include an alarm or signaling mechanism to alert passengers and bystanders of an emergency situation. This could be a loud sound or flashing lights that attract attention.

Monitoring and Feedback: It may be beneficial to have a monitoring system that provides feedback on the status of the emergency exit. This could include sensors or indicators that show whether the exit is securely closed or if there are any malfunctions

It's crucial to remember that installing an automatic emergency exit system for school buses probably necessitates adhering to all applicable safety laws and standards that apply in your area. To guarantee the system's efficacy and compliance, these requirements would need to be taken into account during the design and fabrication processes.

I advise completing an online search or contacting pertinent authorities, transportation safety organisations, or bus manufacturers for the most recent information and particular results regarding the creation of automatic emergency exits for school buses.

Acknowledgment

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