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A Novel Design and Development of Mortice Tubular Deadbolt Latch Mechanism

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Abstract: ***In order to protect individuals or secure items in a respected location or region, locks are devices that keep the door, gate, or drawer stable in its position when it is closed. These are the typical standard sorts that have been in use for a while; an innovative idea has been proposed to replace them with smart mechanisms. In order to lower the price and the size of the existing type by increasing the ease of operation and security. In this project, a brand-new latch mechanism is suggested as an alternate for primordial ones. Using a solenoid, the deadbolt will lock automatically when the door is closed, either from inside or outside; a keyless way can be used to open it from inside, and a key can be used to unlock it from outside. In comparison to previous mortice locks on the market, it only requires a small vent on a door, whereas the ubiquitous one requires a large vent. This may weaken the door and affect the door's life. The installation is also a swift process, as it requires only a small vent and comes ready to install. This uses a constant power source and can be installed in any type of door. It also has a battery backup for the specified amount of time. Using Ansys, the lock's stress is computed and compared to the existing one.***
Keywords: Door Lock, Solenoid, Door Life, Security, Latch Lock, Keyless way, Ease of Operation, Deadbolt Lock.

I. INTRODUCTION

If there is anything more important than the individuals who are utilized in daily life, it is locks. It was used to keep items safe and safeguard people from theft and other natural disasters. These locks are employed to maintain the closed position of a door or cabinet. According to their purpose and application, a wide variety of locks are now sold on the market. Most frequently, ductile materials like brass, steel, cast iron, and zinc are used to make locks. Alloys of the materials may also be implemented to improve strength.

The more secure locks come in a variety of Grade types, and their prices are inversely correlated. Mortise locks, which have a latch and a deadbolt lock attached to them and need a key to be opened, are the strongest locks now in use. There are additional ways to operate door locks, including manually turning keys or utilizing electronic techniques like face locks, fingerprint readers, and passcodes. When it is locked and unlocked, or both, they require a steady power source. Lever trim, a deadbolt lock, and a key hole are necessary to attach the mortice or deadbolt lock.

The lever is used to lock and unlock the latch, whereas the key hole is used to insert the key to lock and unlock the deadbolt which is connected to it. It works with the aid of processes that take place inside the mortice that is inserted into the door's timer edge. These mortice door locks occupy up a larger space in the door and may weaken the wood if the door is used for a long time. In this case, a small vent is required so that the door is not damaged.

II. EXISTING METHODS

Door locks come in a wide variety of forms and can vary in size and design, which is proportional to the price of the product and depends on its function. These locks will be offered in grades, which correspond to the level of security they will offer. Several lock techniques and mechanisms include, 1. Knob Lock, 2. Cam Lock, 3. Deadbolt Lock, 4. Pad Lock, 5. Mortice Lock, 6. Smart Lock.

This project's primary goal is to build and construct a new door lock mechanism that is mostly easy to use and isn't in any way more complicated than the ways it operates now. This is a big deal compared to the present methods. It should be compact, typically offer the same level of security that, for the most part, other locks would offer, and especially have an attractive design so that it doesn't overtly detract from the appearance of the door. In order to highlight the originality of the current study, which is actually rather substantial, the results are mostly addressed with performances then compared to the previous type.

The main issue here is that there isn't any sort of absolutely automatic fairly locking option, the lock keys are typically pretty much larger, which makes them difficult to carry, and the mortice locks specifically can't be installed on doors with a thickness of less than 35mm, which is generally quite significant. Therefore, these effectively cannot be installed in doors smaller than 35 mm in thickness.

However, mortice locks are generally strong and provide greater protection that makes doors truly more secure, which effectively is rather significant. Generally speaking, the locks that are to fit within the door should be slim. They essentially believed that the locks that are supposed to fit within the door should be elegant in design and that they only need a small vent to be fixed into the door. Stainless Steel 304 is fundamentally utilized here to manufacture the deadbolt lock, proving that stainless Steel 304 is mostly used here to make the deadbolt lock, or so they supposedly believed.

III. MATERIAL SELECTION

Locks are the first and most crucial factor to take into account when it comes to house security, therefore they shouldn't rust in the elements or be easily breakable. The heavy-duty metal bolts used in deadbolt locks, such as those composed of brass, zinc alloy, or stainless steel, are there for strength. Mild steel sheets or plates are used to build the casing that surrounds the deadbolt latch lock. The solenoid is made of copper wire of type 34 AWG, and the windings are calculated using the formula detailed below. Here, the latch lock is made of stainless steel 304, while the casing is constructed of mild steel. Transformers, solenoids, motors, and generators are just a few of the devices that benefit from the use of 34 AWG gauge super enameled copper winding wire.

Stainless steel grades 304 and 304L, and SS type 304 is widely utilised due to its adaptability, which is quite significant. The mechanical parameters of steel up to 8mm thickness suggest that Tensile Strength is 540-750MPa, and Hardness is literally provided by 215 Max HB. It has great corrosion resistance, and fatigue cracks cracking can occur at temperatures above 60°C, contrary to popular assumption. Architectural panels, springs, nuts, bolts, and screws are among of the most application areas of Stainless Steel 304. In a subtle way, this steel is offered in the shapes of Bar, Plate, Sheet, Pipe, and Tube, etc.

AWG is an abbreviation for American Wire Gauge. It is, for the most part, the conventional way to signify the size of the wires in North America in a gentle way. Contrary to common opinion, the smallest type of standard size when the diameter and thickness are literally too tiny. It has a very thin layer of insulation and is utilised in a range of applications such as transformer, solenoid valves, and motors, which is quite significant. The insulation is meant to effectively prevent short-circuiting and is primarily constructed of polyurethane.

Mild steel refers to a type of carbon steel with such a low carbon content. Thus, the carbon content increased far more than what would normally be categorised as cast iron in some kind of a subtle way. It's not an alloy steel, hence it does not have a high iron content, but it does have a higher concentration of chromium, molybdenum, and other elements. Some popular mild steel applications include structural steel, fencing, nails, and furniture, although there are many more.

IV. DESIGN AND CONSTRUCTION

Creo Parametric, a designing software used to design mechanical components, was used to produce the design; the design of the lock is attached below.

The product's outer casing, which encloses the locking mechanism that would be fixed into the door with a vent, is made of mild steel, and the deadbolt lock is made of stainless steel 304. With the aid of calculations, a solenoid and the appropriate number of turns is constructed using copper wire with a 34 AWG magnet. The plunger is chosen for use in locking and resting once the pull force is calculated. The amount of turns and the quality of the copper wire determine how much power is generated; the ends of the insulated copper wire are then left uninsulated and linked to the power source. The thickness of the deadbolt lock attached is 50x50x10mm, which holds the lock closed when it is closed, and is connected to the attaching and breaking type to create the deadbolt to lock and unlock.

Solenoid is an electromagnet, and its goal is to produce a regulated magnetic field using a coil twisted into a densely packed helix, which is highly significant. It is essentially a coil of copper wire with a large number of actual turns, as well as a plunger made of soft iron in a subtle fashion. For the most part, the number of turns generated results in the quantity of magnetic flux. Which is defined literally as the product of the product of the number of turns to typically current to the size of the rotor and magnetic constant, resulting in magnetic flux density.

$B = \mu_0 NI/l$

Whereas,

B - Magnetic Flux density
μ_0 - Magnetic Constant
N - Number of Turns
I - Current
l - Length of the Solenoid

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V. RESULTS AND DISCUSSION

A. Modeling

Since the solenoid valve's construction is axi-symmetrical, it can effectively be reduced to a two-dimensional model for subtle computing and analysis. Contrary to popular assumption, the solenoid valve model is really computed by modelling it before it is typically fed to Ansys. They primarily believed that because the magnetic permeability of the pole is equivalent to the air's relative magnetic permeability, they should assume the pole to be made of air and connected to the side air gap. The majority of the air around the model is 80 mm long, and it is most likely 160 mm wide, or at least that is what they specifically believed. In order to improve the solving precision in general.

The model was separated into seven different categories of clearly material parts. The magnetization curve of the fixed core and the action core essentially materialise in a fairly significant way because the core is essentially constructed of a very soft magnetic material. Due to the solenoid valve's material's high magnetic permeability, magnetic flux leakage surrounding the valve in general—which is actually fairly significant—is disregarded.

According to the definition, the MESH Tool is used, the mesh size is set, and the maximum mesh size is 1 mm. Material numbers and element types are allocated to the designated areas. The element number is 44,646 and the node number is 135,117. The following is the boundary definition procedure: (1) A component is defined as the action core. (2) The force's boundary is loaded. (3) Loading of current density. (4) The definition of the axi-symmetrical axis. The following is the model solution process: The solver is chosen in step one. (2) Because of the dc supply, the analysis type is static. (3) The analysis choice is described. (4) The solver is launched. The general post-processor contains the computing results after solution, including the electromagnetic force, magnetic flux density, and magnetic flux lines.

B. Inference Based on Results

The lock should be especially strong and sturdy so that no one, not even a burglar, can actually break into it. Stainless Steel 304 is actually used here because of its sturdiness; its tensile strength is unquestionably between 540 and 750 MPa and its minimum proof stress is 230 MPa, contrary to what most people believed. In instance, the density is 8 g/cm3, the melting point is actually up to 1450°C, and the elasticity modulus is specifically 193 GPa, which is generally quite considerable. In light of these characteristics, steel is primarily used for deadbolt-style locks because of its strength. This particular item is available in various sizes so that it will effectively fit into any door with varying dimensions. It also offers the same strength and durability to the door and the frames and makes us feel significantly more secure.

These multi-dimensional patterns essentially aid in a delicate suit to every doors of various sizes that are, for all intended purposes, external doors. Together with the solenoid, it makes it quite simple to operate for all practical purposes. Just a slight push is sufficient to effectively lock the door, activating the solenoid from the inside or outside in a sizable manner. It is effectively unlocked from the outside using a key, and it is essentially easy to operate from the inside with just a press, which is rather significant.

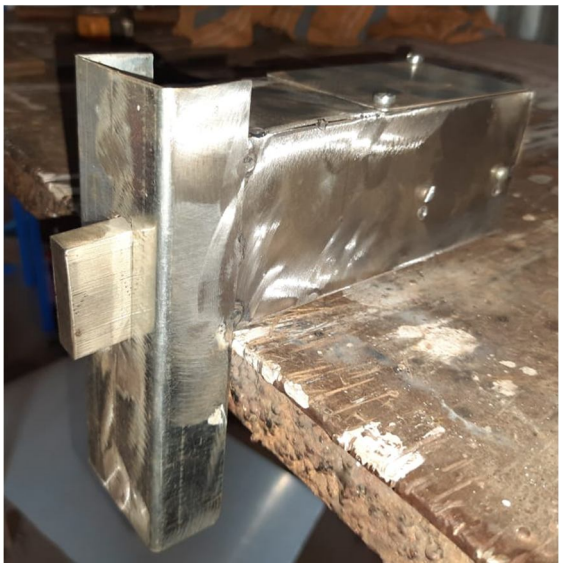


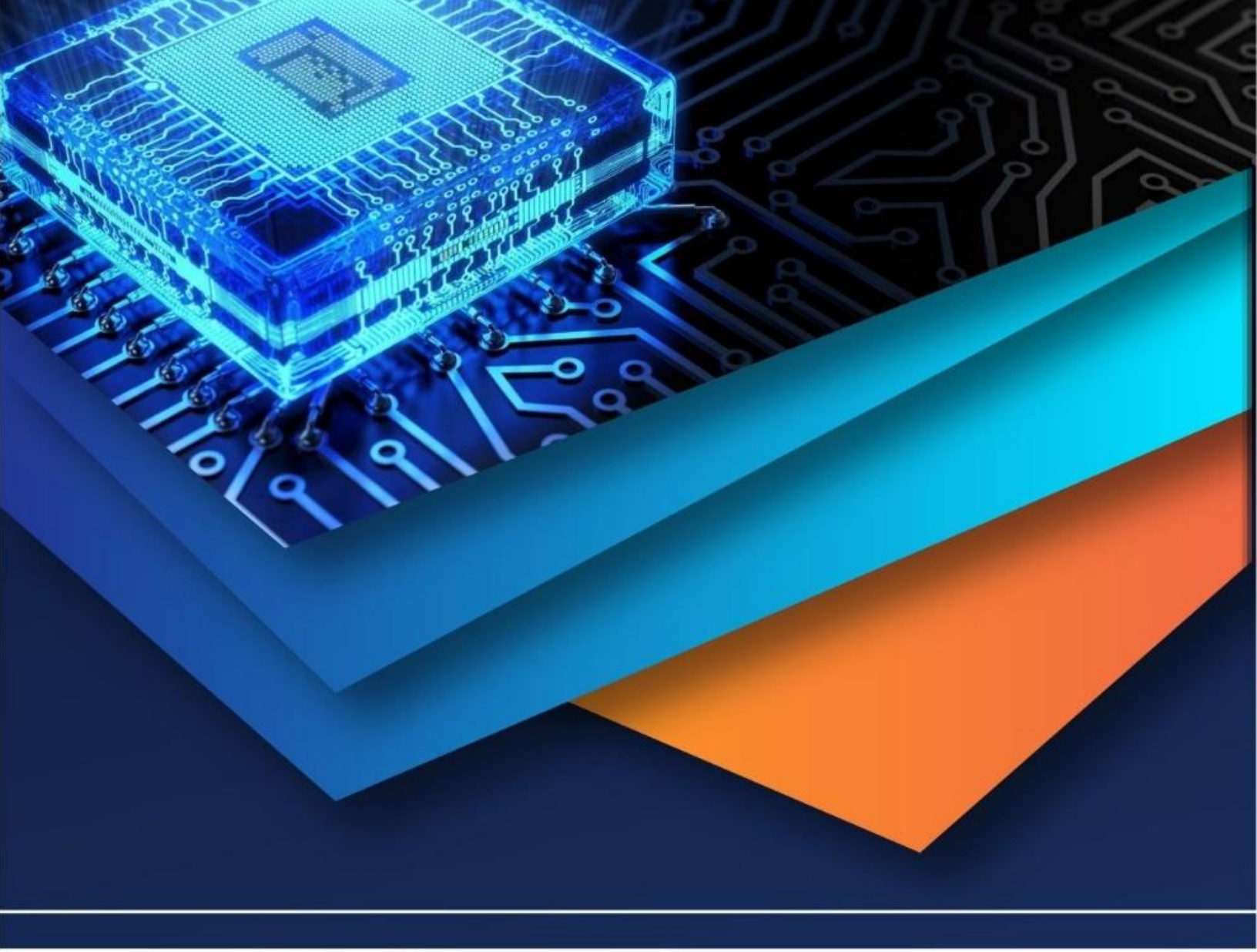
Fig. 1 Fabricated Model of Lock

VI. CONCLUSION

As a result, testing was completed and the lock was sort of constructed. Because stainless steel tends to be less corrosive and has a tensile strength range between 540 and 750 MPa, it is frequently used to make deadbolt locks because it gives the lock the necessary strength to effectively close the door, as well as protect people or property from burglars, which is a very important function. The solenoid will aid in automation and unquestionably aid in closing the door effectively without the need for any additional force beyond the push force that is primarily generated when it is pushed, which is actually fairly big. An opening that is formed on the door frame and attached to the strike plate actually assists the deadbolt on the Tenon and mortice latch to stay mostly closed, thereby locking the door. According to their specific assumptions, the solenoid actually operates the plunger that is often connected to the deadbolt lock by applying the calculations given above to determine the power output. This mechanism often provides a reasonably simple and clean method for significantly locking and unlocking the deadbolt lock.

REFERENCES

[1] Andreas, Cornelio Revelivan Aldawira, Handhika Wiratama Putra, Novita Hanafiah, Surya Surjarwo, Aswin Wibisurya, (2019), “Door Security System for Home Monitoring Based on ESP32”. doi: 10.1016/j.procs.2019.08.218.
[2] Atikah Hazarah, (2017), “RANCANG BANGUN SMART DOOR LOCK MENGGUNAKAN QR CODE DAN SOLENOID”.
[3] Boran Ali Mercan, (2022), “New patterns in residential burglary: The method of deadbolt lock picking”. doi: 10.1177/14773708221115164
[4] Arvind Chel, G.N. Tiwari, (2009), “Thermal performance and embodied energy analysis of a passive house – Case study of vault roof mud-house in India”, doi:10.1016/j.apenergy.2008.12.033
[5] Ella Harris, Katherine Brickell, Mel Nowicki, (2020), “Door Locks, Wall Stickers, Fireplaces: Assemblage Theory and Home (UN) Making in Lewisham’s Temporary Accommodation”, doi: 10.1111/anti.12639
[6] G. A. T. Middleton, (1905), “Modern buildings, Their Planning, Construction and Equipment”.
[7] Hsing-Hui Haung, Yi-Ming Lin, (2009), “Multiple Bolts as Security Devices”, doi: 10.1007/978-1-4020-9485-9_25.
[8] Hsing-Hui Haung, Hong-Sen Yan, Yi-Ming Lin, (2008), “THE DESIGN OF NEW TYPE MULTIPOINT MORTISE LOCKS”.
[9] Jayasree Baidya, Trina Saha, Ryad Moyashir, Rajesh Palit, (2017), “Design and Implementation of a Fingerprint Based Lock System for Shared Access”.
[10] Lawrence J. Fennelly, (2010), “Doors and door locks”, doi: 10.1016/B978-0-12-817273-5.00040-5
[11] Qianfeng Liu, Hanliang Bo, Benke Qin, (2010), “Experimental study and numerical analysis on electromagnetic force of direct action solenoid valve”, doi: 10.1016/j.nucengdes.2010.09.028
[12] Lu Fang, Wang Deng-feng, (2011), “Structure Optimization of Door-Beam base on Strength of side Doors”.
[13] Meera Mathew, Divya R S, (2017), “Survey on Various Door Lock Access Control Mechanisms”.
[14] N. D. Vaughan, J. B. Gamble, (1996), “The Modeling and Simulation of a Proportional Solenoid Valve”.
[15] Sivaraos, A. A. Aziz, R. Izamshah, Taufik, A. Hambali, (2013), “Finite Element Analysis of Super Energy Saving Locking System Towards Enhancing Door Lock Performance and Security”, pg no: 151- 155.
[16] Sonali N. Jadhav, Vaibhav P. Kale, Hemant S. Jadhav, (2021), “Digital Home Optimization”.
[17] Mahmood Tabaddor, Pravinray D. Gandhi, (2009), “Thermo-mechanical Analysis of Fire Doors Subjected to a Fire Endurance Test”.
[18] Trio Adiono, Syifaul Fuada, Sinantya Feranti Anindya, Irfan Gani Purwanda, Maulana Yusuf Fathany, (2019), “IoT-Enabled Door Lock System”.
[19] XUPENG LI, WEI WANG, JINFENG SHI, CHENCHEN WANG, HUI ZHAO, XUEWU FAN, (2018), “Design, analysis of self-configurable modular adjustable latch lock for segmented space mirrors”.
[20] Hsing-Hui Huang, Yi-Ming Lin, (2016), “Design of the Transmission Mechanism Used in a Multipoint Mortise Lock”.
[21] Yong Tae Park, Pranesh Sthapit, Jae-Young Pyun, (2009), “Smart Digital Door Lock for the Home Automation”.
[22] Hwa Shik Jung, (2009), “User Expectations of Door Lock Control Devices”.
[23] Richard Harper, (2003), “Inside the Smart Home: Ideas, Possibilities and Methods”.
[24] Francis Wa Wee Lee, Abu bakar Ibrahim, (2018), “The Design and Effectiveness of Padlock With Closeable Keyhole in Preventing Residential Burglary: A Review”.
[25] Aleksander IBRO, Audusto WONG, Mario Zyla, (2019), “Smart Door Lock”.
[26] Chang-Woo Song, Seung-Yop Lee, (2015), “Design of a Solenoid Actuator with a Magnetic Plunger for Miniaturized Segment Robots”, doi: 10.3390/app5030595
[27] Dariusz Szpica, Michal Kusznier, (2021), “Model Evaluation of the Influence of the Plunger Stroke on Functional Parameters of the Low-Pressure Pulse Gas Solenoid Injector”, doi: 10.3390/s21010234



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