

DEVELOPMENT AND MANUFACTURING OF EMERGENCY DOOR LOCK FOR DIZZINESS SUFFERING PATIENTS

Mr. Gaffar G. Momin¹, Mr. Atharva P. Chaudhari²

¹Assistant Professor in Mechanical Engineering, Department of Mechanical Engineering, Pimpri Chinchwad College of Engineering, Nigdi, Pune-411044, India.

²Student of Mechanical Engineering, Department of Mechanical Engineering, Pimpri Chinchwad College of Engineering, Nigdi, Pune-411044, India

ABSTRACT

The emergency door lock is intended to give a safe and secure method for dizzy patients to lock their bathroom or toilet door from the inside while allowing someone to unlock the door from the outside in an emergency. A caregiver or any person outside the bathroom or toilet can engage the emergency release mechanism. For dizzy patients, the emergency door lock is a crucial safety feature. It can help to keep people from becoming trapped in the restroom or toilet during a dizzy spell. The lock can also provide caregivers and family members peace of mind, knowing the patient is safe and secure. This paper presents designing and implementing a low-cost yet flexible and secure emergency door lock system for dizziness-suffering patients.

Key Words: Emergency Door Lock; An Additive Manufacturing Machine; Polylactic Acid

1. INTRODUCTION

Dizziness is a frequent symptom that can occur at any age. Various circumstances, including inner ear issues, migraines, and certain drugs, can cause it. Dizziness can make walking or standing difficult, and it can also raise the risk of falling.

Everyday chores like using the restroom or toilet might be dangerous for dizzy persons. If the patient has a dizzy spell in the bathroom, they may fall and hurt themselves. If the door is locked, they may be unable to leave the bathroom.

For dizzy patients, the emergency door lock is a crucial safety feature. It enables patients to lock the bathroom or toilet door from the inside while allowing someone outside to open it in an emergency.

The emergency door lock is simple to operate. To engage the lock, the patient must turn it. If the patient requires assistance, a caregiver or another person can use the emergency release mechanism to open the door from the outside.

For dizzy patients, an emergency door lock is a must-have safety measure. It can assist in reducing falls and injuries and offer caregivers and family members peace of mind.

1.1 Features

- 1)It can be easily used.
- 2)It can be fitted on most bathroom and toilet doors.
- 3)Allows the patient to lock the door from the inside.
- 4)Allows someone to unlock the door from the outside in an emergency.
- 5)Provides caregivers and family members with peace of mind.

1.2 Benefits

- 1)Aids in the prevention of falls and injuries.
- 2)Provides a safe and secure manner for dizzy patients to lock the bathroom or toilet door.
- 3) provides caregivers and family members with peace of mind.

Dizziness is a frequent symptom that can occur at any age. Various factors, including inner ear issues, migraines, and certain drugs can cause this. Dizziness can make walking or standing difficult and increase the risk of falling. Simple tasks like going to the bathroom or using the toilet can be risky for vertigo patients. Patients who grow dizzy in the bathroom risk falling and injuring themselves. They are unable to exit the bathroom if the door is locked. Emergency door locks are a crucial safety precaution for dizzy patients.

This allows patients to lock the bathroom or toilet door from the inside while yet allowing someone from the outside to unlock the door in an emergency. The emergency door lock is simple to operate. To engage the lock, the patient turns it. If the patient requires assistance, a caregiver or another person can use the emergency release system to open the door from the outside. Emergency door locks are a vital safety item for dizzy patients. This can help prevent falls and injuries while providing caregivers and family members with peace of mind.

2. REVIEW OF LITERATURE

F. Aman and C. Anitha (2017) described about smart locks that were used to enhance the security features of the house [1].

Sami El Mur Abdallah Kassem, and Georges Jamous (2016), described an intelligent digital door lock system for any lock system. A digital door lock system is any equipment that uses digital information, such as a secret code, instead of the legacy key system [2].

More research is needed to determine the usefulness of emergency door locks for dizzy individuals. However, existing research indicates that these devices can be an effective safety measure.

One study published in the journal Occupational Therapy in Health Care in 2017 discovered that emergency door locks reduced the likelihood of falls and injuries in dizzy patients. Patients who utilized emergency door locks were less likely to fall in the bathroom or toilet and were less likely to be hurt if they did fall, according to the study.

Another study, published in Geriatrics in 2018, discovered that emergency door locks can help dizzy individuals and their caregivers enhance their quality of life.

According to the study, patients who utilized emergency door locks felt more comfortable and secure, and they were less likely to suffer from anxiety and sadness. Patients' caregivers who employed emergency door locks reported feeling less stressed and anxious.

Overall, the study demonstrates that emergency door locks can be an essential safety measure for dizzy patients. These devices can assist in reducing the risk of falls and injuries, as well as improve the quality of life for patients and caregivers by reducing anxiety and sadness.

Literature survey is tabulated in following table 1.

Table 1

Serial no	Title of paper	Author name	Publication year	Conclusion
1	3D PRINTING TECHNOLOGIES IN VARIOUS APPLICATIONS	1 A. Ramya 2 Sai leela Vanapalli	June 2016	3D printing is shifting from prototyping to producing low-volume, custom parts for industries like life sciences (implants) and automotive (vintage car spares)
2	An Overview on 3D Printing Technology: Technological, Materials, and Applications	1 N. Shahrubudina 2 T.C. Leea 3 R. Ramlana	2019	3D printing, or additive manufacturing, builds objects layer-by-layer from digital designs, offering mass customization and open-source possibilities. Applications are booming in diverse fields like agriculture, healthcare, and transportation (automotive, locomotive, aviation)
3	The Impact and Application of 3D Printing Technology	Cephas Mawere	June 2014	3D printing, the layer-by-layer creation of objects from digital designs, transcends industries like manufacturing, healthcare, and beyond. Its versatility extends to diverse materials (plastic, metal, nylon etc.) and offers cost-effective solutions across fields. As applications continue to expand, 3D printing's future holds immense potential for innovation and disruption

4	3D Printing Technology and its Applications in Real-World Scenario	1 Nandkishor Dhawale 2 Nitesh Chavan	Feb 2022	3D printing's adaptability, ease of adoption, and growing popularity hold the potential to revolutionize supply chains, but achieving technological maturity and infrastructure readiness is crucial
5	CROWDSOURCED DESIGN PRINCIPLES FOR LEVERAGING THE CAPABILITIES OF ADDITIVE MANUFACTURING	1 Katja Hölttä-Otto 2 Kristin Lee Wood	Jan 2015	This research identified 23 key design principles, from general to specific, to unlock the full potential of additive manufacturing, offering valuable guidance for designers and maximizing the technology's capabilities.
6	MODERN RAPID 3D PRINTER - A DESIGN REVIEW	T. Prabhu	3, May–June 2016	By continuing to explore and refine 3D printing technology, we can unlock its vast potential for creating customized objects, fostering innovation, and transforming manufacturing as we know it
7	The Processes and Technologies of 3D Printing	1 JABBAR QASIM AL-MALIKI 2 ALAA JABBAR QASIM AL-MALIKI	October 2015	3D printing is rapidly evolving and becoming increasingly accessible, opening up a world of possibilities for design, prototyping, and manufacturing. As the technology continues to develop, we can expect even more exciting applications and advancements in the years to come
8	Parametric Optimization of The Process of Fused Deposition Modeling In Rapid Prototyping Technology- A Review	1 Vishal N. Patel 2 Kamlesh P. Kadia	December 2014	FDM part quality significantly depends on factors like layer thickness, air gap, raster width, contour width, and raster orientation.
9	A Review of Additive Manufacturing	1 Kaufui V. Wong 2 Aldo Hernandez	16 Aug 2012	Overcoming existing hurdles and embracing technological advancements will be crucial for wider adoption in mainstream manufacturing
10	Recent advances in 3D printing of biomaterials	1 Helena N Chia 2 Benjamin M Wu	2015	Exploring biocompatible and multifunctional materials, optimized printing parameters, and advanced bioprinting techniques hold immense potential for creating functional tissues and organs
11	Application and Performance of 3D Printing in	1 Wenyong Liu 2 Ying Li 3 Jinyu Liu	Sept 2013	This study explored the performance of 3D printing (3DP) in fabricating nanobiomaterials and devices, specifically analyzing its influence on

	Nanobiomaterials	4 Xufeng Niu 5 Yu Wang 6 Deyu Li		performance and safety. The key findings of the research can be summarized as follows
12	Fused Deposition Modeling – A Rapid Prototyping technique for Product Cycle Time Reduction cost effectively in Aerospace Applications	Prof. Deepa yagnik	2014	FDM is a cost-effective and versatile RP technique suitable for creating intricate aerospace components. The case study of Kaveri engine development demonstrates the significant time and cost savings achieved through FDM-based prototyping
13	Importance and utilization of 3D printing in various applications	1 Shivraj Narayan Yeole 2 Sri Nidhi Hrushi Kesav Regula 3 Y. Shivraj Narayan	January 2016	Its applications range from simple everyday objects to advanced aerospace components and medical devices. Continuous advancements in materials, technology, and software hold immense promise for future innovation
14	3D Printing Technology, Material Used For Printing and its Applications	1 Ajay Anil Shinde 2 Ashutosh Dandekar 3 Rahul Patil 4 Nandkishor Dhawale	July 2020	paper highlights the extensive range of applications where 3D printing excels. From rapid prototyping and customized object fabrication to complex industrial prototypes and medical devices, the technology's reach extends across various sectors. This wide-ranging applicability reinforces the immense potential of 3D printing in revolutionizing design, manufacturing, and product development processes
15	Additive Manufacturing (AM) Design Principle Cards	1 K Blake Blake Perez 2 Kristin Lee Wood	January 2019	This research paper addresses the critical need for new sources of design knowledge specifically tailored to additive manufacturing (AM). Recognizing the unique capabilities of AM technologies, the authors propose an innovative methodology for extracting and formalizing AM design principles
16	On Design Rapid Prototyping and Testing of IoT Enabled Sensors Using Open Source Tools	1 Dr. Nandkishor M. Dhawale 2 Ms. Sneha A. Patil 3 Mr. Aditya R. Rajput	10 Oct 2021	This research paper tackles the challenge of rapid prototyping and testing an IoT-enabled sensor device using readily available open-source tools. The authors address the need for a structured set of instructions within the vast knowledge base on IoT, often scattered and lacking practical

		4 Mr. Kiran A. Shinde 5 Mr. Rohan S. Kulkarni 6 Mr. Nitesh R. Chavan		implementation details
17	RAPID PROTOTYPING TECHNOLOGY: APPLICATIONS, ADVANTAGES AND LIMITS -A REVIEW	1 Boini Sriharsha 2 P. Sudhakar Rao	December 2018	this paper offers a valuable roadmap for navigating the often-fragmented landscape of IoT development. By providing a practical and open-source framework, the authors contribute to accelerating the creation and testing of innovative IoT solutions
18	An Optimization Approach for Components Built by Fused Deposition Modeling with Parametric Internal Structures	1 L Villalpando 2 Hasti Eiliat 3 Ruth Jill Urbanic	May 2014	This research paper delves into the optimization of internal support structures in Fused Deposition Modeling (FDM) for additive manufacturing. Recognizing the limitations of existing solid and shell approaches, the authors propose a novel strategy utilizing reconfigurable parametric internal structures
19	Application and Performance of 3D Printing in Nanobiomaterials	Xiaoming Li	Sept 2013	This research paper investigates the application of 3D printing (3DP) in the fabrication of nanobiomaterials and devices, highlighting its potential and challenges
20	Models of the emergence and diffusion of mass customization	Maciej Walczak	2014	This research paper explores the concept of mass customization, a contemporary strategy aiming to reconcile the benefits of both mass production and tailored products
21	Product development for future using rapid prototyping techniques	1 Jayant Morey 2 Sandeep Kongre	Dec 2017	application of rapid prototyping techniques extremely promising for future product development. The ability to quickly and iteratively create physical models from 3D models offers numerous advantages over traditional methods
22	Feasibility Study on 3D Printed Patterns in Casting	1 Aby K Abraham 2 Vinay Pramod 3 Abhijith Baiju 4 Akash Babuji 5 Rijo	June 2015	The ability to rapidly create complex geometric forms with FDM technology offers intriguing possibilities for patternmaking, potentially saving time and resources compared to traditional methods

		Plathanam		
23	Component Replication using 3D Printing Technology	1 Dr. B.Satyanarayana 2 Kode Jaya Prakashb	December 2015	This research paper demonstrates the promising potential of 3D printing technology for component replication, specifically in the context of creating duplicate keys
24	Application of 3D Printing for Human Bone Replacement	1 Azem Yahamed 2 Pavel Ikonomov 3 Paul D. Fleming	June 2021	this research represents a significant step forward in exploring the potential of 3D printing for human bone replacement. As an engineer, I see numerous challenges and opportunities ahead
25	Metallization on FDM Parts Using the Chemical Deposition Technique	1 Azhar Equbal 2 Anoop Kumar Sood	September 2014	This research offers valuable insights into metallization of ABS parts fabricated using FDM technology for potential electrical applications
26	Investigation of the effect of built orientation on mechanical properties and total cost of FDM parts	1 Sandeep Rauta 2 VijayKumar S. Jattib 3 Nitin K. Khedkar 4 T.P.Singh	December 2014	This research effectively demonstrates the significant impact of build orientation on both the mechanical properties and total cost of FDM-printed ABS parts
27	Parameter Optimization of ABS-M30i Parts Produced by Fused Deposition Modeling for Minimum Surface Roughness	Dinesh Kumar S	April 2014	This research investigates the effect of various FDM process parameters on the surface roughness of parts built with a novel ABS-M30i biomedical material.
28	The priorities of elderly patients suffering from dizziness: A qualitative study	1 Carsten Kruschinski 2 Gudrun Theile 3 Sabine Dorothee Dreier 4 Eva Hummers-Pradier	Jan 2010	This study, conducted among elderly patients experiencing dizziness, highlights the importance of patient-centered communication in managing this common complaint. Through interviews, researchers identified key priorities and concerns expressed by these patients

2.1 Additional Benefits of Emergency Door Locks for Dizziness-Suffering Patients

Patients

Aside from the safety benefits, emergency door locks can give various other advantages to dizzy patients, including:

1. Peace of mind: Knowing that the patient is safe and secure in the bathroom or toilet can provide patients and caregivers with peace of mind.
2. freedom: Emergency door locks can assist dizzy patients in maintaining their freedom and dignity. Patients can use the restroom or toilet without fear of becoming confined or falling.

3. Reduced danger of social isolation: Emergency door locks can enable dizzy patients to participate in social activities more fully. Patients can visit restaurants, cafes, and other public locations without fear of becoming stuck in the restroom or toilet.

Emergency door locks are an essential safety precaution for dizzy patients. These devices can assist in reducing the risk of falls and injuries, as well as improve the quality of life for patients and caregivers by reducing anxiety and sadness.

3. MATERIALS AND METHOD

The material used for manufacturing of emergency door locks is Polylactic Acid, which is, in short, written as PLA. It is a thermoplastic derived from renewable, organic sources such as corn starch or sugar cane. Using biomass resources makes PLA production different from most plastics, which are produced using fossil fuels through the distillation and polymerization of petroleum. PLA material is wound on a bobbin which is represented in fig.1.



Fig.1 Bobbin of PLA material

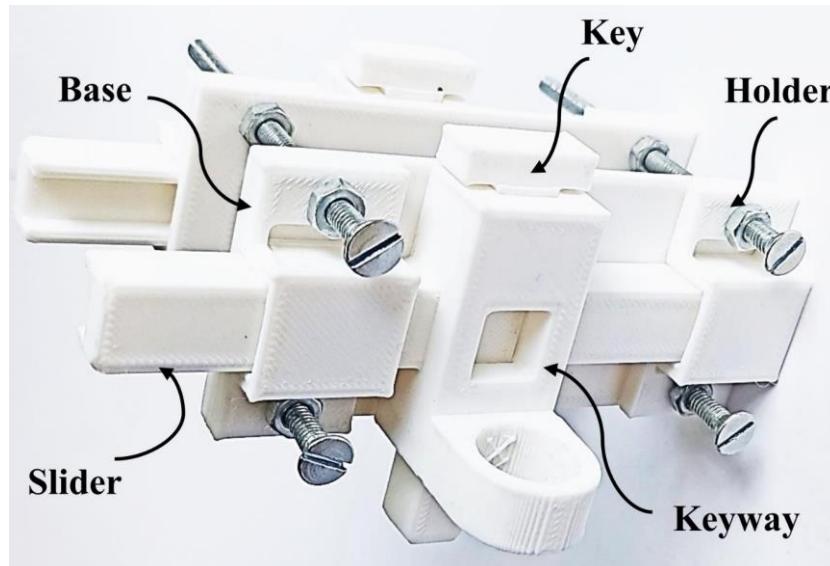


Fig.1 Assembly Drawing for Emergency door lock

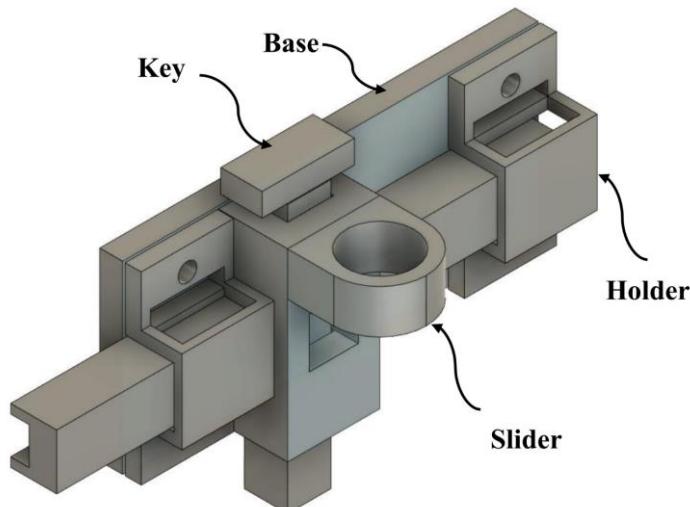


Fig.3 Side Assembly for Emergency Door Lock

The material utilized is PLA (Polylactic Acid) , a long-lasting and inexpensive filament that is ideal for 3D printing. Autodesk Fusion 360, a popular CAD software that can output STL files, is used to construct the design. The STL file was then sliced with Creality slicer, which generates G-code files for 3D printers. The door lock parts are manufactured once the G-code files are placed into a 3D printer. After printing, the parts are assembled with assembly tools. The end product is a valuable and cost-effective method for fastening emergency doors.

The door lock is designed with Autodesk Fusion 360, a popular CAD software that can export STL files. STL files are a standard 3D printing format that can be imported into any slicing software.

The STL door lock file is then sliced with Creality slicer, which creates G-code files for 3D printers. G-code is a programming language used to control the movements of 3D printers.

The door lock parts are manufactured once the G-code files are placed into a 3D printer. The door lock parts took roughly 4 hours to produce.

After printing, the parts are assembled with assembly tools. The assembling process is quite simple and takes about 30 minutes.

Fig.2 represents the assembly drawing for the Emergency Door Lock. Fig.3 represents the Side assembly for the Emergency Door Lock.

Table No.1 shows the material properties of material for PLA + plastic which is utilized for manufacturing of the Emergency Door Lock.

Table 2

Sr.No.	Property	Value
1	Heat Deflection Temperature(HDT)	52 ⁰ C
2	Density	1.24 g/cm ²
3	Tensile Strength	50 Mpa
4	Flexural Strength	80 Mpa
5	Impact Strength (Unnotched) IZOD (J/m)	96.1
6	Shrink Rate	0.37-0.41 inch/min

The machine utilized for the emergency door lock is represented in Fig. 4. This machine is an Additive Manufacturing Machine.



Fig.4 An Additive Manufacturing Machine

4. RESULT AND DISCUSSION

The emergency door lock is a secure and effective technique for dizzy patients to lock their bathroom or toilet door from the inside while yet allowing someone to unlock the door from the outside in the event of an emergency.

For dizzy patients, the emergency door lock is a crucial safety feature. It can help to keep people from becoming trapped in the restroom or toilet during a dizzy spell.

The lock can also give caretakers and family members peace of mind, letting them know their loved one is safe and protected.

The emergency door lock is simple to install and use. It is also reasonably priced.

The emergency door lock is a helpful alternative for dizzy people who live alone or with caregivers who may not be able to respond to an emergency right away.

Overall, the emergency door lock is an important safety feature for dizzy patients. It is safe, effective, and simple to apply.

The emergency door lock could be improved further by including the following features:

1. A sensor that detects if the patient has fallen and automatically unlocks the door.
2. In an emergency, a two-way communication system allows the sufferer to communicate with someone outside the bathroom or toilet.
3. A backup power system in case of a power outage.

Regardless of these prospective enhancements, the emergency door lock is a crucial safety measure for dizzy patients in its current state.

5. CONCLUSION

For dizzy patients, the emergency door lock is a crucial safety feature. It enables patients to lock their bathroom or toilet door from the inside while yet letting someone to unlock it from the outside in the event of an emergency. This can assist prevent patients from becoming confined in the case of a dizzy episode and provide caregivers and family members with peace of mind.

For dizzy patients, the emergency door lock is a crucial safety feature. It is safe, effective, and easy to use. The emergency door lock can help to prevent patients from getting trapped in the bathroom or toilet in the event of a dizzy spell. It can also provide peace of mind for caregivers and family members, knowing that the patient is safe and secure.

We encourage all dizziness-suffering patients to consider installing an emergency door lock in their bathroom or toilet. It is a small investment that can make a big difference in your safety and well-being.

6. FUTURE SCOPE

Manual door locks have a limited future because they are very basic mechanisms. There are, however, a few possible areas for improvement.

Security Manual door locks are susceptible to lock picking and lock bumping. Manufacturers of manual door locks may design new locking systems that are more resistant to these attacks in the future.

Convenience: Manual door locks can be difficult to use, particularly for persons with impairments or restricted mobility.

Manufacturers of manual door locks may create new features that make it easier to unlock and lock doors in the future, such as voice-activated locks or locks that can be opened with a smartphone app.

Affordability:

Although manual door locks are generally inexpensive, there is always space for improvement. Manual door lock manufacturers may create new manufacturing techniques or employ new materials in the future to make their goods even more affordable.

The future of manual door locks is quite restricted in general, however there are a few potential areas for improvement. Manual door lock makers can continue to add value to their products by focusing on security, simplicity, and cost.

Another possible area of improvement for manual door locks is in the field of sustainability. In the future, makers of manual door locks may create new products produced from recycled materials or driven by renewable energy sources.

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