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Article

An Application to Intelligent Control for the Robot Type Toilet

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Abstract: A toilet intelligent seat applications is applied to the field of innovations for robotics and automation technology. Some applications are presented here for toilet intelligent flushing mechanism, direct smell out type toilet intelligent seat mechanism, lift type toilet intelligent seat mechanism, robot type toilet cleaner, robot type toilet stool sampler, and robot type toilet top opener. They would be also presented to the international exhibition of innovations. For the robots applied usually to the industrial e.g. in manufacturing, packing and moving etc. It would be the novelty for the robots applied into the field of toilet for intelligent seat applications. The technical details of the intelligent controller methods used in toilet intelligent close loop mechanism provided in precision operation and listed, e.g. help person to save water, keep air clean, stand up, clean seat, make a stool sampler, and open the top and seat.

Keywords: toilet; intelligent; seat; application; robot

1. Introduction

Many kinds of robot applications were presented. Adamu et al. [1] in 2023 presented the robot's navigational operations to mobile control and avoiding obstacles. Basheer [2] in 2022 presented the application reviews of soft robots applied in life, house ware, space, and industry. Macrorie et al. [3] in 2021 presented the fourth industrial revolution (4IR) of robotics and automation technology (RAT) for the urban cities. Bademosi and Issa [4] in 2021 presented the RAT of industry 4.0 operations to determine the positive and negative factors in the construction. Mahmud et al. [5] in 2020 presented the possibilities and challenges of RAT in the agriculture. Madakam et al. [6] in 2019 presented the robotic process automation (RPA) for the computer fields of advanced digital technologies. Tzafestas [7] in 2018 presented the internet of things (IoT) and artificial intelligence (AI) for robotics and industrial automation applications. Recently, Bashar et al. [8] in 2024 presented the advanced RAT of the industrial manufacturing for the US and Bangladesh. Ajiga et al. [9] in 2024 reviewed the software automation for the long-term return on investment (ROI) in the industries. Huang et al. [10] in 2024 presented the RPA for the digital transformation of healthcare. Koppisett [11] in 2024 presented the

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RPA for the fast automation and less error of financial services, healthcares and manufacturing.

Technical state of the art in the RAT for toilet intelligent seat were presented as follows. There are toilet intelligent flushing mechanism, direct smell out type toilet intelligent seat mechanism, lift type toilet intelligent seat mechanism, robot type toilet cleaner, robot type toilet stool sampler, and robot type toilet top opener. It is the novelty for the robots applied into the field of toilet in the rest room for intelligent seat applications.

2. State of the art

Base on the close loop control system, the traditional controller can be upgraded into the intelligent controller that is used to control the robot as shown in Fig. 1. The intelligent controller usually implemented with the programmed language to adjust the signals of input and sensor, then to provide the intelligent signal into actuator to rotate or translate the robot mechanism. The intelligent controller would be better and more controllable than that in the traditional controller. Some technical statements in the RAT for toilet intelligent seat were presented as follows.

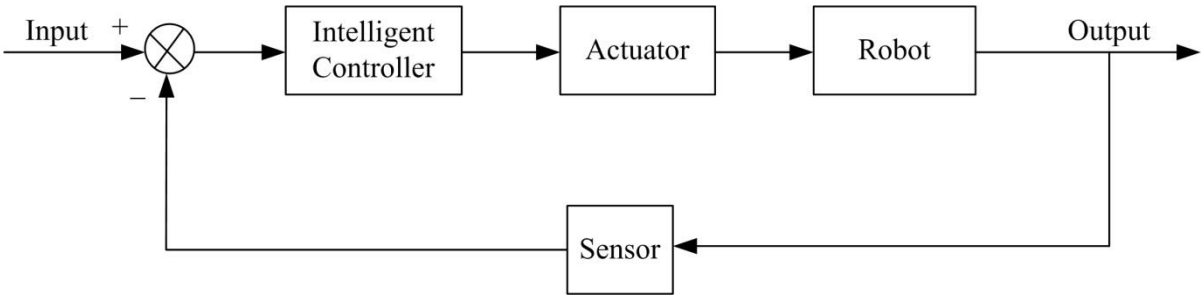

Fig. 1 Intelligent controller in the close loop control system

2.1. Toilet intelligent flushing mechanism

Toilet intelligent flushing mechanism used to save precious water for the exactly control of flushing and without leaking. The toilet intelligent flushing mechanism consists of an intelligent screen, electronic control panel, water pipe solenoid valves and sensors as shown in Fig. 2. The important of this might be contributed to the water saving technique with precision inlet and outlet of the water in the innovation design of toilet intelligent flushing mechanism. The parts name corresponding to the number and character in Fig. 2 for the design and control used in the toilet intelligent flushing mechanism. In the toilet bucket and top cover for toilet seat, the inlet water in inlet water pipe and the outlet water in outlet water pipe that are controlled by intelligent control device. By using the electronic control panel, screen button, inlet water pipe solenoid valves, outlet water pipe solenoid valves, the actuated signals are coming from no.1 water level sensor and no.2 water level sensor to control automatically for the height of water.

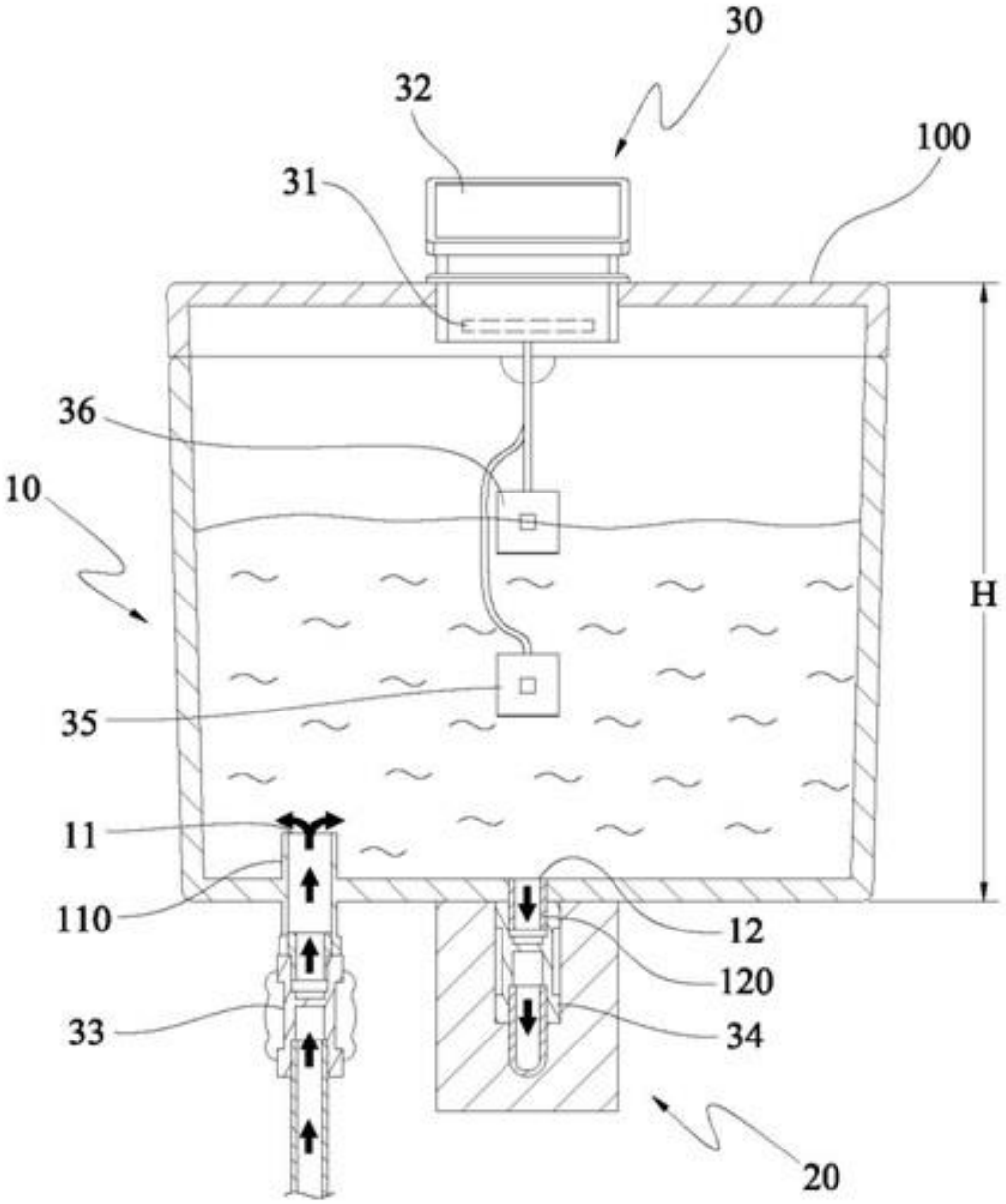

Fig. 2 Toilet intelligent flushing mechanism [12].

2.1.1 Contributions made in Fig. 2

The notation used for Fig. 2 in which 10: toilet bucket, 100: top cover, 20: toilet seat, 30: intelligent control device, 33: inlet water pipe solenoid valves, 37: control panel, 38: screen, 11: inlet water, 110: inlet water pipe, 12: outlet water, 120: outlet water pipe, 31: electronic control panel, 32: screen button, 34: outlet water pipe solenoid valves, 35: no.1 water level sensor, 36: no.2 water level sensor, H: bucket height. Thus toilet intelligent flushing mechanism can be used to save water in precision. The contributions of the close loop work in toilet intelligent flushing mechanism would be used to save more water than that used in open loop conventional methods.

2.2 Direct smell out type toilet intelligent seat mechanism

Direct smell out type toilet intelligent seat mechanism used to control the smell out immediately. The direct smell out type toilet intelligent seat mechanism consists of an intelligent electronic control panel, motor fan and pipe and smell detected sensors as shown in Fig. 3. The important of this might be contributed to the direct smell out technique with precision control the smell out through pipe in the innovation design of toilet intelligent seat mechanism. The parts name corresponding to the number in Fig. 3 for the design and control used in the direct smell out type toilet intelligent seat mechanism. The motor fan is controlled by intelligent electronic control panel and direct smell out controller with detected sensors to keep clear air.

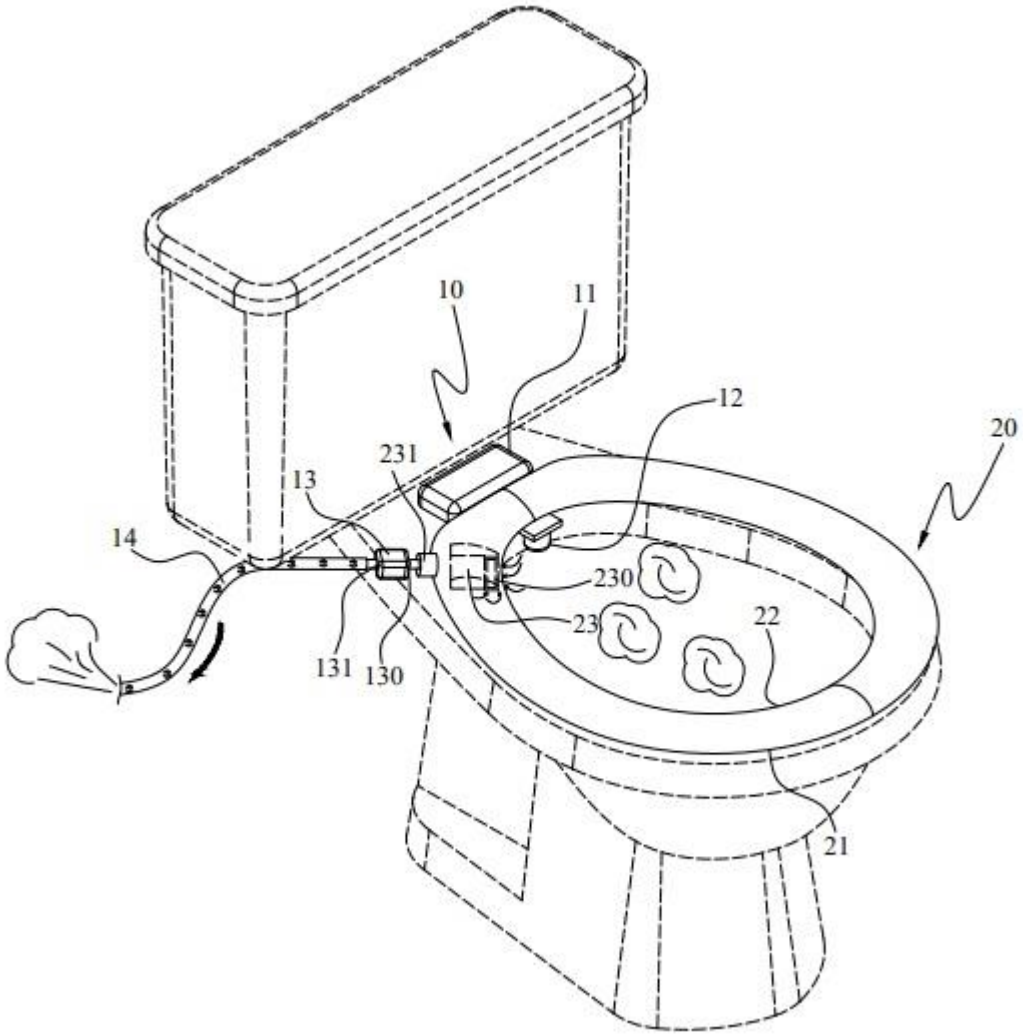

Fig. 3 Direct smell out type toilet intelligent seat mechanism [13].

2.2.1 Contributions made in Fig. 3

The notation used for Fig. 3 in which 10: direct smell out controller with detected sensors, 11: intelligent electronic control panel, 12: smell detected sensors, 13: motor fan, 130: inlet, 131: outlet, 14: pipe, 20: toilet seat mechanism, 21: outer ring, 22: inner ring, 23: chamber, 230: vent, 231: pipe fixer. Thus direct smell out type toilet intelligent seat mechanism can be used to keep air clean in precision. The contributions of the close loop

work in direct smell out type toilet intelligent seat mechanism would be used to keep air more clean than that used in open loop conventional methods.

2.3 Lift type toilet intelligent seat mechanism

Lift type toilet intelligent seat mechanism used to control the up and down of seat. The lift type toilet intelligent seat mechanism consists of an intelligent screen, electronic control panel, seat position sensors, and lift mechanism as shown in Fig. 4. The important of this might be contributed to the lift technique with precision control the body up and down in the innovation design of toilet intelligent seat mechanism. The parts name corresponding to the number in Fig. 4 for the design and control used in the lift type toilet intelligent seat mechanism. The toilet seat is controlled by intelligent lift mechanism with seat up and down controller and position sensors to go up and down for the needed people to stand up and sit down easily.

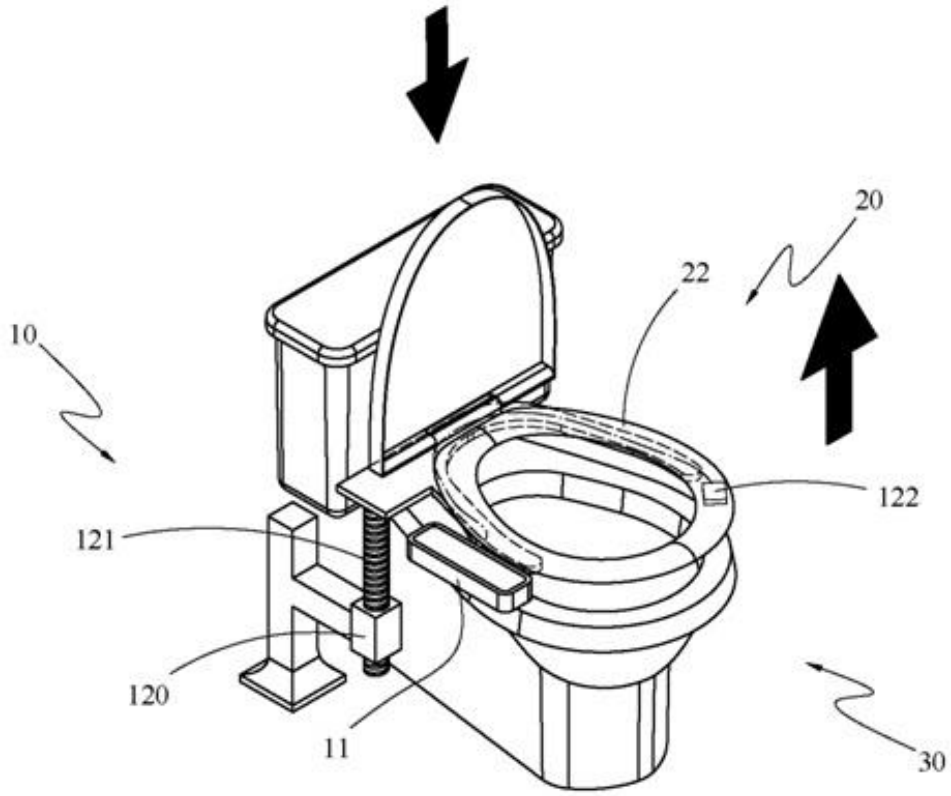

Fig. 4 Lift type toilet intelligent seat mechanism [14].

2.3.1 Contributions made in Fig. 4

The notation used for Fig. 4 in which 10: seat up and down controller, 11: control device, 110: intelligent screen, 111: electronic control panel, 111A: power supply plug, 112: position sensors, 12: intelligent lift mechanism, 120: up and down control motor, 121: up and down screw, 122: up and down seat support, 20: toilet seat, 21: lift seat, 22: seat, 23: cover, 30: toilet. Thus lift type toilet intelligent seat mechanism can be used to help person stand up in precision. The contributions of the close loop work in lift type toilet intelligent seat mechanism would be used to help person to stand up more easier than that used in open loop conventional methods.

2.4 Robot type toilet cleaner

Robot type toilet cleaner used to control and clean the dirty position in toilet. The robot type toilet cleaner consists of a robot, electronic control panel, cleaner and sensors as shown in Fig. 5. The important of this might be contributed to the toilet cleaner technique with precision controlling the robot in the innovation design of toilet intelligent mechanism. The parts name corresponding to the number in Fig. 5 for the design and control used in the robot type toilet cleaner. The toilet cleaner is actuated by the robot mechanism with intelligent electronic control device and sensors to reduce people work of toilet cleaning.

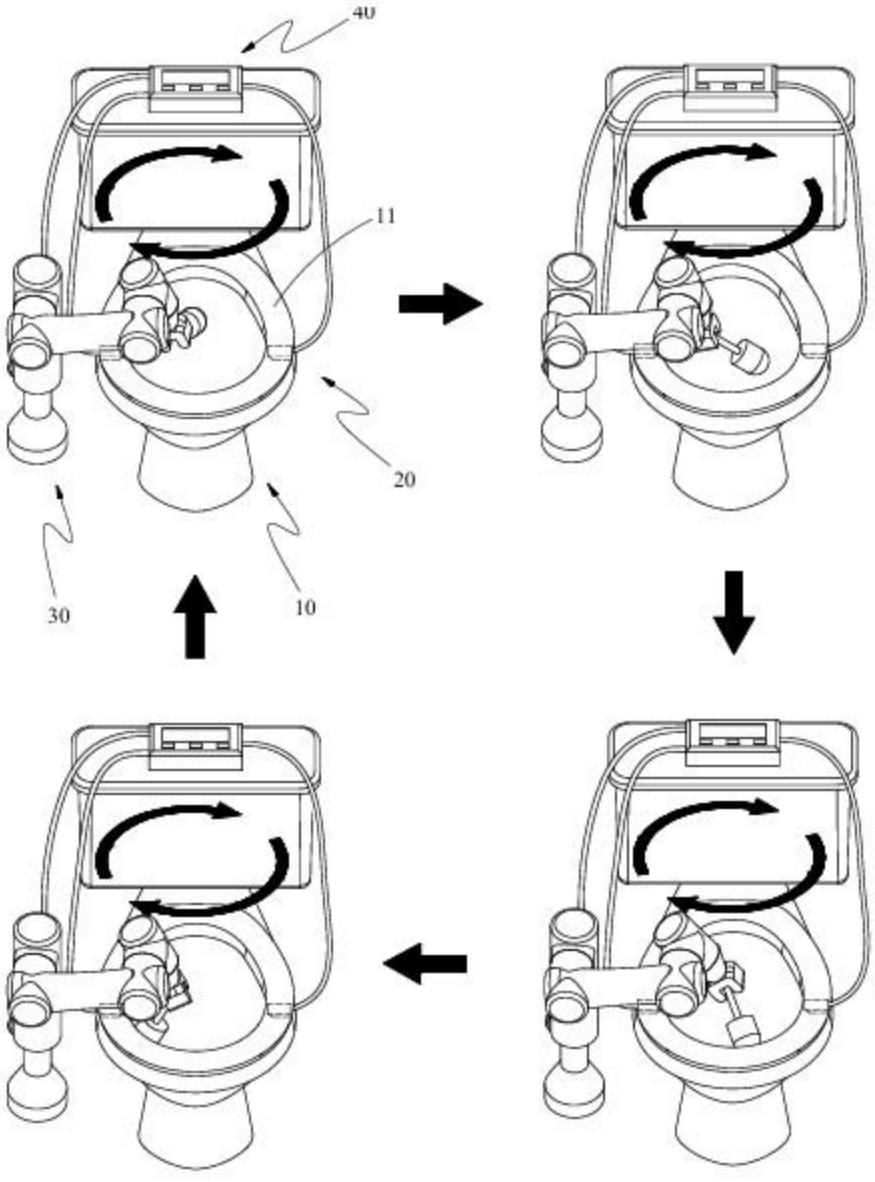

Fig. 5 Robot type toilet cleaner [15].

2.4.1 Contributions made in Fig. 5

The notation used for Fig. 5 in which 10: toilet, 11: toilet seat, 20: sensors, 30: robot type toilet cleaner, 31: robot mechanism, 310: rotating clamp, 32: cleaner, 40: intelligent electronic control device, 41: control panel, 42: button, 43: screen. Thus robot type toilet cleaner can be used to help person to clean seat in precision. The

contributions of the close loop work in robot type toilet cleaner would be used to help person to clean seat more easier than that used in open loop conventional methods.

2.5 Robot type toilet stool sampler

Robot type toilet stool sampler used to control and complete the sampler of the stool position in toilet. The robot type toilet stool sampler mechanism consists of a robot, electronic control panel, stool sampler and sensors as shown in Fig. 6. The important of this might be contributed to the toilet stool sampler technique with precision controlling the robot in the innovation design of toilet intelligent mechanism. The parts name corresponding to the number in Fig. 6 for the design and control used in the robot type toilet stool sampler. The stool sampler is actuated by the robot mechanism, electronic control panel, sensor and end clip to make a stool sampler in toilet.

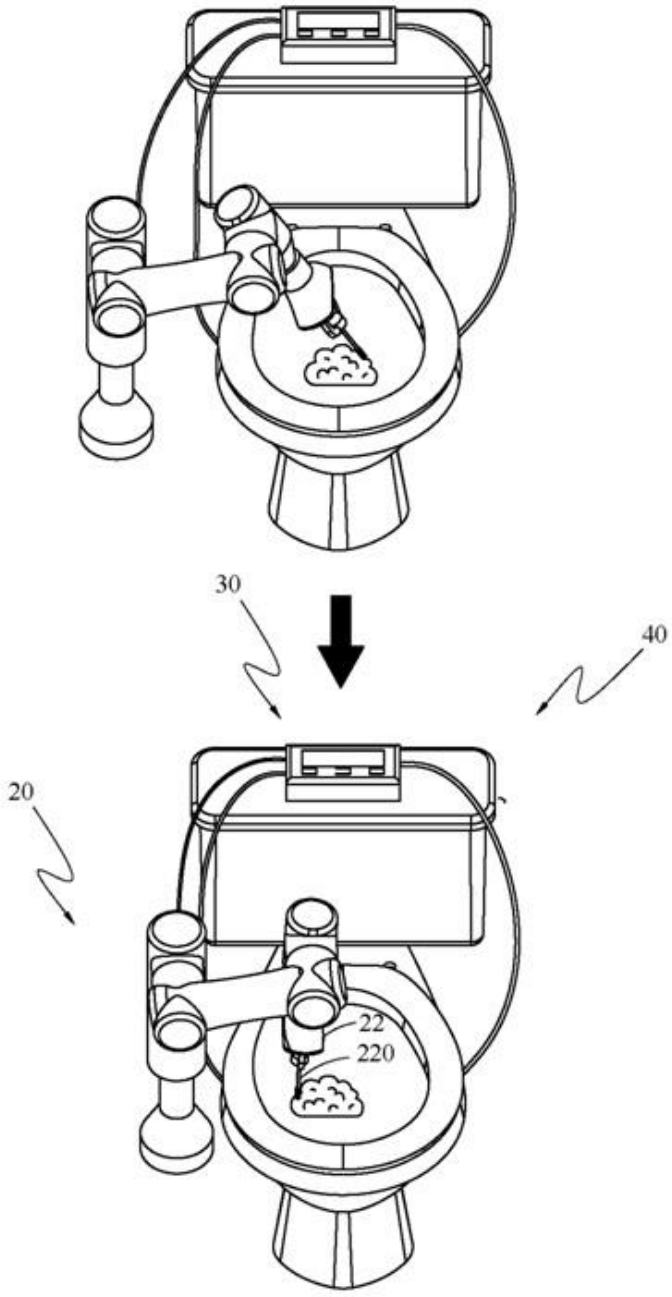

Fig. 6 Robot type toilet stool sampler [16].

2.5.1 Contributions made in Fig. 6

The notation used for Fig. 6 in which 20: robot, 22: clip, 220: sampler, 30: electronic control panel, 40: toilet. Thus robot type toilet stool sampler can be used to help person to make a stool sampler in precision. The contributions of the close loop work in robot type toilet stool sampler would be used to help person to make a stool sampler more easier than that used in open loop conventional methods.

2.6 Robot type toilet top opener

Robot type toilet top opener used to control the top position in toilet. The robot type toilet top opener mechanism consists of a robot, electronic control panel, top opener modules and sensors as shown in Fig. 7. The important of this might be contributed to the toilet top opener technique with precision controlling the robot in the innovation design of toilet intelligent mechanism. The parts name corresponding to the number in Fig. 7 for the design and control used in the robot type toilet top opener. The toilet top opener is actuated by the robot mechanism, electronic control panel, sensor and end clip to open the top and seat in toilet.

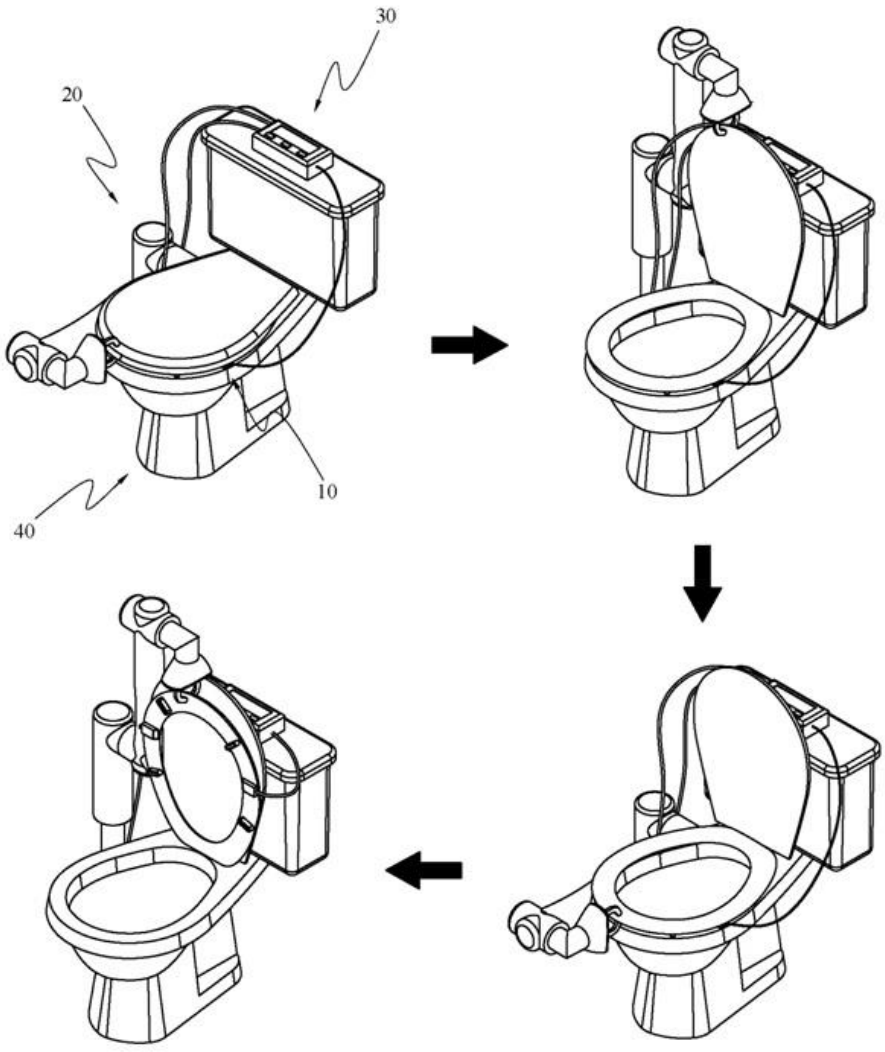

Fig. 7 Robot type toilet top opener [17].

2.6.1 Contributions made in Fig. 7

The notation used for Fig. 7 in which 10: sensor, 20: robot, 30: electronic control panel, 40: toilet. It is interesting to prevent and clean possible germs by using the design based on robot type toilet top opener. Thus robot type toilet top opener can be used to help person to open the top and seat in precision. The contributions of the close loop work in robot type toilet top opener would be used to help person to open the top and seat more easier than that used in open loop conventional methods.

3. Discussions

For future work, if possible to examine the application's and the controller's good performance. In the present time, the ideal design in state of the art basically and firstly are presented. For the examination in the application's and the controller's good performance, it is possible to implement high level languages, e.g. Python, Arduino, Raspberry Pi, etc. programmed language worked with the programmable logical controller (PLC) in intelligent controller. When the implement of software and mechanism hardware are prepared, it is interesting to process sufficient results to assess the efficacy of the application in future.

Some comparisons with similarly existing works in the field of toilet design and concept are discussed as follows. In 2015, Hashemi et al. [18] presented a innovative flushing system toilet to reduce water less than common toilets for 13 - 16 liters in every one flush. In 2012, Bock et al. [19] presented a wheelchair design in bathroom to help elderly people to make more good service and assistance than the existing aids in basic activities of daily livings (BADLs). In 2024, Vidyalakshmi et al. [20] presented an automated toilet design with Arduino Uno central processing unit (CPU), ultrasonic sensor and direct circuit (DC) motors used in cleaning system to make precise cleaning job. In 2023, Esmaeilzadeh [21] presented an artificial intelligence (AI) toilet seat for older adults' using survey investigation, there are myriad factors, e.g. early detection of diseases, easy to use, healthcare cost reduction etc., affected them to decide and like to use it. In 2017, Maric et al. [22] presented a self-cleaning toilet design by a using an ultraviolet (UV) light to clean the toilet seat.

4. Conclusions

Applications are presented in state of the art for toilet intelligent flushing mechanism, direct smell out type toilet intelligent seat mechanism, lift type toilet intelligent seat mechanism, robot type toilet cleaner, robot type toilet stool sampler, and robot type toilet top opener. It is novelty for the robots applied into the field of toilet by using intelligent seat applications. The intelligent controller would be better and more controllable than that in the traditional controller for people toilet live in the future. It is possible and necessary to implement high level languages, e.g. Python, Arduino, Raspberry Pi, etc. worked with the PLC in intelligent controller CPU chips.

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Conflict of Interest

There is no conflict of interest for this study.

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