

AUTOMATED DELIVERY AND INTELLIGENT COMMUNE

Technical Field

- 5 The present invention relates, in general terms, to methods and systems, including robots, for delivery of a commode.

Background

- 10 There has been an increasing demand to automate the non-patient care matters so that the clinical staff can focus on delivering patient care. For example, out-patients undergoing chemotherapy increases their toilet usage frequency due to the treatment. As they are undergoing chemotherapy, their output waste contains a level of chemical. Hence, we propose a robotic system to
15 automatically deliver a commode to the patient, as well as to dispose the bedpan used by patients undergoing chemotherapy because their waste can be toxic due to their treatment. The proposed robotic system includes a mobile robot which delivers the commode to the patient when needed and a commode that is smart to detect the patient trying to get off the commode without nurse
20 assistance.

It would be desirable to overcome or ameliorate at least one of the above-described problems, or at least to provide a useful alternative.

Summary

- In response to the above issues, the present invention relates to automation of delivery of commode as well as design of a smart commode to detect a patient trying to get off the commode, and other smart features of the commode.

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Disclosed is a system for delivering a commode to a patient, comprising:
a transceiver system;

a commode delivery robot; and
a commode,

wherein the system receives, at the transceiver system, a commode request,
and in response to the commode request the commode delivery robot delivers

5 the commode to the patient, and

wherein the system receives, at the transceiver system, a completion request,
and in response to the completion request the commode delivery robot delivers
the commode to a disposal location.

10 In response to the commode request, the commode delivery robot may collect
the commode and deliver the commode to the patient. The commode may be
one of a plurality of commodes and the commode delivery robot may
consequently select the commode from the plurality of commodes based on an
indication that the commode (i.e. that being selected) is sanitised. The
15 indication may indicate at least that the commode comprises a clean bedpan.

The commode delivery robot may be configured to separate from the commode
after delivering the commode to the patient.

20 One or both of the commode and commode delivery robot may comprise a
detector for detecting when the patient is attempting to leave the commode.
The system may further comprise an alert system configured to raise an alert
on detection by the detector of the patient attempting to leave the commode.
The detector may be further configured to receive an indication that a care giver
25 is overseeing the patient attempting to leave the commode. The alert system
may be configured to raise an alarm only if the detector does not detect the
care giver. The detector may comprise a weight detector.

Also disclosed is a method for delivering a commode to a patient, comprising:

30 receiving, at a transceiver system, a commode request;
delivering, using a commode delivery robot, the commode to the patient
in response to the commode request;
receiving, at the transceiver system, a completion request; and

delivering, using the commode delivery robot, the commode to a disposal location in response to the completion request.

Delivering the commode to the patient may comprise collecting the commode
5 and delivering the commode to the patient. The commode may be one of a plurality of commodes, the method thus further comprising selecting the commode from the plurality of commodes based on an indication that the commode is sanitised.

10 The method may further comprise separating the commode delivery robot from the commode after delivering the commode to the patient.

The method may further comprise detecting, using a detector on one or both of the commode and commode delivery robot, when the patient is attempting to
15 leave the commode. The method may further comprise raising an alert, using an alert system, on detection by the detector of the patient attempting to leave the commode. The method may thus involve receiving, at the detector, an indication that a care giver is overseeing the patient attempting to leave the commode. The alarm may be raised only if the detector does not detect the care
20 giver.

Brief description of the drawings

Embodiments of the present invention will now be described, by way of non-
25 limiting example, with reference to the drawings in which:

Figure 1 shows images (a) to (c) in which a commode is called, delivered, used, picked up and taken away for processing of bedpan;

30 Figure 2 shows a commode delivery robot;

Figure 3 depicts a commode disposal location; and

Figure 4 shows images (a) to (k) of a practical application of a system in accordance with present teachings.

Detailed description

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Hospitals have been facing growing pressure to attract the nursing staff due to shortage of manpower and heavy daily duties. One critical issue that is in-part responsible for the short staffing issue is that nurses have to do some day-to-day tasks that are cumbersome yet necessary. In addition, nurses are often
10 exposed to risk should the necessary precautionary procedures not be strictly followed. One example is the delivery of a commode followed by the disposal or emptying of the bedpan in the chair of the commode.

Disclosed is a system for automating commode delivery and disposal – e.g.
15 disposal of contents of the commode or bedpan of the commode. Such a system is reflected in the workflow of Figure 1. The workflow implements a method for delivering a commode to a patient. The method comprises receiving, at a transceiver system, a commode request. The commode request can be initiated by a patient calling for a chair or commode – step 100. On initiation by the
20 patient, the call is received by the receiver of the system. The receiver may comprise part of a commode delivery robot, may wirelessly communicate with the commode delivery robot, or may be part of a base station where the commode delivery robot awaits instruction to deliver or dispose of a commode.

25 After the commode request is received, the commode delivery robot delivers a commode to the patient. Where the commode delivery robot contains or comprises a commode, it may move directly to the patient. In other embodiments, in response to the commode request, the commode delivery robot moves to collect the commode or chair – step 102, and delivers the
30 commode to the patient – step 104. In some cases, the commode is one of a plurality of commodes. The commode delivery robot then navigates to the commodes, selects a commode – e.g. based on the commode being nearest the

commode delivery robot, the commode having been used the least recently of all commodes in the plurality of commodes, and/or that the commode has been sanitised or comprises a clean bedpan – and delivers the commode to the patient.

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The commode delivery robot may navigate to each destination (e.g. commode pickup location, patient and disposal location) using any known robot navigation system. Ideally, that robot navigation system will use image recognition, to avoid collisions particularly in clinical settings.

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After delivering the commode, the commode delivery robot may separate from the commode, or may remain with the commode, depending on the desired application. When the commode delivery robot separates from the commode during use, the commode delivery robot can be used to deliver a second

15 commode.

The patient uses the commode and thereafter sends a completion request – step 106. The completion request is received at the transceiver system, which instructs the commode delivery robot to pick up the commode. This can include

20 returning with the commode. Alternatively, the commode delivery robot may navigate back to the patient – step 108, pick up the commode and deliver the commode to a disposal location. This alternative embodiment enables a single commode delivery robot to deliver a commode to one patient while it awaits completion of use of another commode by another patient – i.e., a single

25 commode delivery robot can concurrently service the commode requirements of multiple patients.

The disposal location can include a manipulator per step 110 that manipulates the commode to empty it or dispose of the bedpan. To enable the commode to

30 be emptied (e.g. the bedpan disposed on in a macerator), the commode delivery robot docks the commode at a docking plate of the manipulator – step 112.

Patients in clinical settings are often people who are in a condition of impaired mobility. As such, a patient attempting to leave a commode may have a fall. To that end the commode and/or commode delivery robot may comprise a detector for detecting when the patient is attempting to leave the commode. In one
5 embodiment, the commode comprises a pressure sensor or weight detector for detecting when a patient is sitting on the commode and thus when the patient endeavours to rise from the commode. The commode delivery robot may comprise a visual sensor – e.g. image capture or camera system – that analyses a visual feed in a known manner to determine when a patient is rising from the
10 commode or has fallen.

If a patient endeavours to leave the commode, the system may produce an alert using an alert system such as an audible alarm, visual alert or message to a device such as a smart phone or hospital monitoring system.

15 Similarly, a caregiver may indicate that they are with the patient, such as by clearing the alarm or pre-emptively disabling the alarm. The disablement or alarm clearance may provide to the detector an indication that the caregiver is with the patient. The detector may therefore only raise the alarm when it does
20 not detect a caregiver.

Figure 2 illustrates a commode delivery robot 200 in accordance with present teachings. The robot 200 comprises a motorised body 202, that contains the motors and control to move the robot 200 during navigation. The robot 200 also
25 comprises a transceiver 204 that wirelessly receives signals instructing the robot 200 where to navigate to and the task to perform (delivery, drop off, pick up or disposal). During navigation, a camera 210 captures images that are analysed in a known manner to detect hazards and to facilitate control of the robot 200. The robot 200 further comprises one or more grippers 206 for engaging a frame
30 of the commode, to enable the robot 200 to move the commode. The grippers 206 of some embodiments are pneumatic and are actuated using a pneumatic system 208. During drop off, the grippers 206 release the commode.

Once the commode has been used by a patient, the bedpan therein needs to be disposed of. To that end, the robot 200 delivers the commode to a disposal location such as that reflected in Figure 3. The commode 300, is deposited next
5 to the disposal location. A manipulator – e.g. a robotic, articulated arm 302 – collects the bedpan 304 from the commode using any suitable attachment or engagement mechanism such as a gripper 306 or magnetic attachment (for metal bedpans). The robotic arm 302 then delivers the bedpan to a disposal unit – e.g. a macerator 308 for disposal. In some embodiments, the bedpan is
10 reusable. As such the gripper 304 may need to change grip to enable the bedpan to be turned over and emptied. The change of grip can be performed at a grip change station 310.

The process is further set out in Figure 4, images (a) to (k) in which a robotic
15 system automatically disposes of waste, such as chemotherapy waste and other wastes. Broadly speaking, the design includes commode chair that is either integral with the commode delivery robot or is separate therefrom. In Figure 4, image (a), the patient requests the commode. After which, the robot delivers the commode to the patient as shown in Figure 4, image (b). The robot has
20 been designed such that it is capable of engaging the commode and delivering it to the patient – e.g. using grippers as mentioned above. During commode delivery, a navigation stack is used for navigation through a potentially crowded clinical environment. As demonstrated in Figure 4, image (c), the robot can navigate while around people, in some instances slowing or stopping when it
25 detects people – e.g. using a video feed from camera 210. In addition, the robot may employ a modified algorithm that prevents it from continually stopping when there is a person walking in front and in the same direction as the robot. The robot will instead wait and resume the motion once the person moves away as reflected by Figure 4, image (d). Upon reaching the patient, the robot will
30 release the commode as illustrated in Figure 4, image (e). The nurse will help the patient onto the commode – Figure 4, image (f). To reduce fall incidents, a pressure/force sensor has been incorporated into the commode such that an

alarm will be triggered when the patient tries to get up without the nurse as shown in Figure 4, image (g). Once the patient is done, the robot returns to collect the commode as shown in Figure 4, images (h) and (i). The robot then delivers the commode to the disposal room – Figure 4, image (j). The
5 manipulator then places the bedpan on a weighing scale, records the weight and takes a photo – Figure 4, image (k). After which, the robot removes the commode the whole cycle restarts.

It will be appreciated that many further modifications and permutations of
10 various aspects of the described embodiments are possible. Accordingly, the described aspects are intended to embrace all such alterations, modifications, and variations that fall within the spirit and scope of the appended claims.

Throughout this specification and the claims which follow, unless the context
15 requires otherwise, the word “comprise”, and variations such as “comprises” and “comprising”, will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

20 The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this
25 specification relates.

Claims

1. A system for delivering a commode to a patient, comprising:
 - a transceiver system;
 - 5 a commode delivery robot; and
 - a commode,wherein the system receives, at the transceiver system, a commode request, and in response to the commode request the commode delivery robot delivers the commode to the patient, and
- 10 wherein the system receives, at the transceiver system, a completion request, and in response to the completion request the commode delivery robot delivers the commode to a disposal location.
2. The system of claim 1, wherein, in response to the commode request, the
- 15 commode delivery robot collects the commode and delivers the commode to the patient.
3. The system of claim 2, wherein the commode is one of a plurality of commodes and the commode delivery robot selects the commode from
- 20 the plurality of commodes based on an indication that the commode is sanitised.
4. The system of claim 3, wherein the indication indicates at least that the commode comprises a clean bedpan.
- 25 5. The system of any one of claims 1 to 4, wherein the commode delivery robot is configured to separate from the commode after delivering the commode to the patient.
- 30 6. The system of any one of claims 1 to 5, wherein one or both of the commode and commode delivery robot comprises a detector for detecting when the patient is attempting to leave the commode.

7. The system of claim 6, further comprising an alert system configured to raise an alert on detection by the detector of the patient attempting to leave the commode.
- 5 8. The system of claim 7, wherein the detector is further configured to receive an indication that a care giver is overseeing the patient attempting to leave the commode.
9. The system of claim 8, wherein the alert system is configured to raise an alarm only if the detector does not detect the care giver.
- 10 10. The system of any one of claims 6 to 9, wherein the detector comprises a weight detector.
- 15 11. A method for delivering a commode to a patient, comprising:
receiving, at a transceiver system, a commode request;
delivering, using a commode delivery robot, the commode to the patient in response to the commode request;
receiving, at the transceiver system, a completion request; and
20 delivering, using the commode delivery robot, the commode to a disposal location in response to the completion request.
12. The method of claim 11, wherein delivering the commode to the patient comprises collecting the commode and delivering the commode to the patient.
- 25 13. The method of claim 12, wherein the commode is one of a plurality of commodes, the method further comprising selecting the commode from the plurality of commodes based on an indication that the commode is sanitised.
- 30 14. The method of any one of claims 11 to 13, further comprising separating the commode delivery robot from the commode after delivering the commode to the patient.

15. The method of any one of claims 11 to 14, further comprising detecting, using a detector on one or both of the commode and commode delivery robot, when the patient is attempting to leave the commode.
- 5 16. The method of claim 15, further comprising raising an alert, using an alert system, on detection by the detector of the patient attempting to leave the commode.
- 10 17. The method of claim 16, further comprising receiving, at the detector, an indication that a care giver is overseeing the patient attempting to leave the commode.
- 15 18. The method of claim 17, wherein raising an alarm comprises raising an alarm only if the detector does not detect the care giver.