Internal Ref: OR20C030

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THE PATENTS ACT, 1970

(39 of 1970)

The patent Rule, 2003

COMPLETE SPECIFICATION

(See section 10 and rule 13)

TITLE OF THE INVENION

A system for identifying accurate region of interest for syringing in mammals and method thereof

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Internal Ref: OR20C030

Preamble to the Description

[0001] The following specification describes the invention and the manner in which is to be performed:

DESCRIPTION OF THE INVENTION

Technical field of the invention

[0002] The present invention relates to a system for syringing in mammals. More particularly, the invention relates to a system to detect the blood vessels using thermal or Infrared (IR) imaging or other accurate region of interest by means of a camera along with a Machine Learning (ML) based needle positioning for automatically injecting the medicine or withdrawal of bodily fluid or fluid collection from the body. The invention also relates to a method for identifying the accurate region of interest for Intravenous (IV) using IR and syringing using camera in Intramuscular (IM), Intradermal (ID), Subcutaneous (SC), neural blocks for automatically injecting the medicine or withdrawal of bodily fluid or fluid collection from the body in mammals.

Background of the invention

[0003] Many important medical procedures such as diagnostic tests, therapeutic procedures, vaccination, diabetic and chemotherapeutic treatment, etc., involve various modes of syringing such as intramuscular, intravenous, subcutaneous, intradermal, etc.

[0004] Several times the health workers may find it difficult to identify or access the blood vessels in case of obese, collapsed or thin patients as well as in infants. Thus, resulting in multiple pricks causing needle stick injury in patients. Additionally, the hazard of inappropriate identification of the region of interest for syringing or inappropriate syringing technique may result in various medical problems in both patients as well as health workers, which includes blood borne diseases. Moreover, inappropriate administration of dosage would also lead to

thrombocytopenia. Hence, it requires acquiring years of experience and skills, especially in paramedical staff to position the needle appropriately to deliver medicines with minimized error along with minimizing the pain.

[0005] While, a lot of people suffer from fear of injections or needles, it becomes extremely difficult to handle patients and to carry out such procedures due to the fear of pain and the phobia associated with such patients. Trypanophobia relates to fear of needle, the condition was recognized in 1994. The phobia results in avoiding the blood tests or appropriate medical care in the affected individual, who refrains from visiting the health worker. The fear or phobia is likely to be genetic in infants or geriatric patients, but there exist different types of needle phobia irrespective of age.

[0006] The patent application "**US20150112260A1**" entitled "*Thermal and near infrared detection of blood vessels*" discloses systems and methods for non-invasive detection of blood vessels. The systems and methods involve uniform cooling of a tissue volume below the skin region for a specified cooling period and then image the thermal footprints of vessels below the skin as they heat up the skin region. The systems comprise a thermal imaging device configured to image the skin region after the cooling period, an image processor to identify the images captured by the thermal imaging device, which arise on the skin region after discontinuation of the cooling, and a displaying means configured to present the identified vessel thermal footprints. The system and methods analyze the spatio-temporal patterns of the natural heating of the skin surface to derive data on the location of the vessels under the skin.

[0007] The patent application "**US20130041258A1**" entitled "*Imaging-guided anesthesia injection systems and methods*" discloses devices and systems for injecting fluids, such as anesthetics, to or near nerve tissue or other targeted anatomical location. A conduit is configured to place the fluid delivery module in fluid communication with a needle that is configured to be inserted into the patient's anatomy. One or more drugs (e.g., anesthetics) and/or other materials

contained within containers (e.g., vials) that are secured to the injection system is selectively delivered into an anatomy through the needle. The target anatomical location is identified by using nerve stimulation and/or imaging technologies such as ultrasound and the needle location is confirmed by using aspiration. Apart from the real-time imaging data, an overlay on the imaging display includes data and other information relating to back pressure at or near the needle tip, volumes or other amounts of fluids delivered by and remaining within the system, stimulation level, etc.

[0008] The patent application "**US9959391B2**" entitled "*Medicine administering system including injection pen and companion device"* discloses the methods, systems, and devices for administering a medicament to a patient. According to an embodiment, the system includes an injection pen device in wireless communication with a mobile communication device. The injection pen device comprises a housing including a chamber to encase a cartridge containing medicine, a dose setting and dispensing mechanism to set the mechanism to dispense a particular dose of the medicine from the loaded cartridge, a sensor unit to detect a dispensed dose based on positions and/or movements of the dose setting and dispensing mechanism, and an electronics unit in communication with the sensor unit to process the detected dispensed dose and time data associated with a dispensing event and to wirelessly transmit the dose data to a user's device. The mobile communication device provides a software application to provide the user with health information using the processed dose data.

[0009] The patent application "**CN210095745U**" entitled "*Automatic needle inserting device"* discloses an automatic needle inserting device. The device comprises a bracket, at least one pressurizing device, a scanning device, a clamping module, an automatic needle discharging device, a control driving module and a man-machine interaction module. Each pressurizing device is in signal connection with the control driving module, wherein the pressurizing device comprises a pressurizing ring and a pressurizing hose. One end of each pressurizing hose is connected to the pressurizing ring, and the other end of each

pressurizing hose is connected with the support. The automatic needle discharging device comprises a needle placing groove, a needle head clamping device and a needle head storage cavity, wherein the needle head clamping device is arranged in the needle placing groove. The invention discloses an automatic device with simple operation pricks that can effectively improve the success rate of pricking and alleviate patient's misery.

[0010] The patent application "**JP6637567B2**" entitled "*Automatic injection device*" discloses an autoinjector apparatus comprising a single-use cassette and an autoinjector. The cassette comprises a housing and a sleeve movably disposed in the housing. A syringe may be disposed in the sleeve and secured therein with a locking cap. The locking cap is affixed to a distal end of the sleeve and contacts the distal end of the syringe. A shield remover extends through an opening in a proximal end of the housing for removing a needle shield which covers a needle of the syringe. A cassette identification arrangement is provided on a surface of the housing to enable the autoinjector to identify the cassette. The autoinjector is provided with a detector for reading the cassette identification arrangement.

[0011] The patent application "**EP2654843B1**" entitled "*Auto-injector*" discloses an auto-injector for administering a dose of a liquid medicament. The auto-injector comprises a substantially tubular front-end device adapted to contain a syringe with an injection needle and a barrel containing the dose of the medicament and comprising a needle shroud adapted to rest on the skin of a patient receiving an injection and a reusable back-end device comprising a housing, a plunger connected to or adapted to engage a stopper providing a fluid-tight seal for a distal end of the barrel, a motor, e.g. an electric motor for displacing the plunger connected to the stopper.

[0012] The patent application "**CN101553266B**" entitled "*An automatic miniature injector and sample-taker device for medical use*" discloses automatic and miniaturized injector and sample-taker device for medical use. The injector and the device comprise an enclosure and at least one needle movable relative to

said enclosure. The injector and sample-taker device includes a detector system for detecting the presence of a blood vessel in a predetermined volume, a control unit for controlling the displacement of the needle as a function of information provided by said detector system, and at least one reservoir for containing a substance for injection or to be taken.

[0013] The patent application "**US9486584B2**" entitled "*Automatic injection device*" discloses a method for treating a disorder using an automatic injection device. The device comprises a syringe movably disposed in a housing and includes a barrel portion, a needle and a stopper for sealing the barrel portion. The device comprises a syringe actuation component for moving the syringe towards a first open end of the housing such that the needle projects from the first end, and for subsequently applying pressure to the stopper. The syringe actuation component includes a pressurizer, a rod comprising a compressible portion projecting therefrom, and a flange between a second end of the rod and the compressible portion. The device further comprises a biasing mechanism for biasing the syringe actuation component towards the first open end of the housing, the biasing mechanism disposed about the second end of the rod between the flange and a second end of the housing.

[0014] There are many systems, devices or apparatus available for injecting the medicines or withdrawal of bodily fluid or fluid collection from the body, however very few results in procedure with minimized error and minimized pain. Further, the available apparatus may not eliminate human error while syringing, as syringing depends on the skill and experience of the health worker involved in the procedure. Hence, there is a need for an alternative approach to prevent and reduce multiple pricks or inappropriate identification and the consequences arising from such errors along with eliminating the needle phobia associated with certain individuals.

Summary of the invention

[0015] The present invention overcomes the drawbacks in the existing prior art by providing a syringing system with minimized error and minimized pain, designed for overcoming needle phobia in mammals. The invention further overcomes the difficulties in identifying the accurate region of interest while injecting the medicines or withdrawal of bodily fluid or fluid collection from the body.

[0016] The invention discloses a system to identify the accurate region of interest using thermal or Infrared (IR) imaging along with Machine Learning (ML) based needle positioning as per the mode of syringing. The system automatically injects the medicine or withdrawal of bodily fluid or fluid collection from the body.

[0017] The invention also relates to a method for identifying the region of interest for automatically injecting the medicine or withdrawal of bodily fluid or fluid collection from the body in mammals. The invention discloses the method of identifying the blood vessels for Intravenous (IV) mode using IR imaging or identifying the region of interest for Intramuscular (IM), Intradermal (ID), Subcutaneous (SC), neural blocks by means of a camera, in addition to the ML based needle positioning in mammals.

[0018] The system comprises an automatic syringing system connected to an electronic controller to receive input parameters for controlling and communicating to other components of the system, a mechanical controller to provide one or more control parameters such as positioning, rotating the angle of the syringe according to the accurate region of interest while syringing, a selection unit to choose the mode of syringing such as the IV, IM, ID, SC, neural blocks etc., by either a set of push buttons or remote control or a mobile application or any Human-Machine Interface (HMI), a positioning unit to align the needle, a rotating unit to rotate the syringe at a required angle, a syringing unit to operate the syringe by either injecting the medicine or withdrawing the blood or withdrawal of bodily fluid or fluid collection from the body of the mammal as per the requirement. The system further comprises a gripper to hold the syringe with

the needle, a covering unit to cover the syringe and the needle, in order to minimize the needle phobia by concealing the syringe and a needle component within the covering unit. A display unit along with the selection unit may be optionally provided on the covering unit. The display unit displays the motion of needle while syringing. A binding unit may also be optionally provided on the covering unit. The binding unit comprises a strap to wrap around the region of syringing. Further, a lighting source such as an IR lighting unit for illuminating the region of syringing and a camera to capture one or more images, is connected to a processor to process the captured images of the blood vessel during IV mode or the camera which aids in identifying the accurate region of interest in case of syringing in IM, ID, SC or neural block modes, which in turn provides for proper alignment of needle by the positioning unit for syringing in mammals. The automatic syringing system identifies the accurate region of interest wherein the mammal includes human beings but can be extended to other class of mammals.

[0019] Thus, the invention discloses a system, which is operable in both automatic and semi-automatic mode based on the mode of syringing and the amount of human intervention involved while syringing.

[0020] The invention also discloses a method for identifying the accurate region of interest for syringing in mammal. The method comprises binding the system on a mammal, removing the needle cap, selecting the mode of syringing such as IV, IM, ID, SC or neural blocks, focussing the IR lighting unit and the camera for IV syringing or focussing the camera for syringing in IM, ID, SC or neural block modes, capturing one or more images to detect the accurate region of interest, processing the sequence of images captured, positioning the gripper to align the needle according to the mode of syringing selected, rotating the gripper to adjust the angle of the needle according to the mode of syringing selected along with ML based positioning, injecting the medicine or withdrawal of blood from the blood vessels or withdrawal of bodily fluid or fluid collection from the region of interest, displaying the motion of the needle while syringing in a mammal.

[0021] Thus, the invention involves the ML-based positioning and control mechanism for automatic syringing to identify the blood vessels or the accurate region of interest. Therefore, minimizing human errors and pain through an adaptive control mechanism while injecting the medicine or withdrawal of bodily fluid or fluid collection from the body.

Brief description of the drawings

[0022] The foregoing and other features of embodiments will become more apparent from the following detailed description of embodiments when read in conjunction with the accompanying drawings.

[0023] Figure 1 illustrates a system for identifying the accurate region of interest for syringing in a mammal according to an embodiment of the invention.

[0024] Figure 2 illustrates a flow chart for a method to identify the accurate region of interest for syringing in a mammal according to an embodiment of the invention.

Detailed description of the invention

[0025] In order to make the matter of the invention clear and concise, the following definitions are provided for specific terms used in the following description.

[0026] The term "*Infrared imaging*" also including thermal imaging refers to imaging based on infrared radiation including thermal radiation.

[0027] The term "*Syringe*" refers to a medical device used for injecting fluid or withdrawal of fluid from the body.

[0028] The term "*Machine Learning*" refers to the computer programs that can learn and adapt from experience without being programmed or human intervention.

[0029] The term "*Intravenous injection*" or the IV injection refers to the administration of fluid or the medication into the vein.

[0030] The term "*Intramuscular injection*" or the IM injection refers to the administration of fluids or the medication deep into muscles.

[0031] The term "*Subcutaneous injection*" or the SC injection refers to administration of medication into the tissue layer between the skin and the muscle.

[0032] The term "*Intradermal injection*" or the ID injection refers to administration of medication into the dermis.

[0033] The term "*Human-Machine Interface*" or the HMI is a user interface that allows human to interact with the machine.

[0034] The invention discloses the system for identifying the accurate region of interest for syringing in mammals. More particularly, the invention discloses a system to identify the accurate region of interest based on the mode of syringing along with Machine Learning (ML) based needle positioning to automatically inject the medicine or withdrawal of blood from the blood vessel or withdrawal of bodily fluid or fluid collection from the body of the mammal.

[0035] The invention further discloses the method for identification of the accurate region of interest for syringing in mammals.

[0036] The system is useful to identify the accurate region of interest based on the mode of syringing selected, along with IR imaging for identifying the blood vessels in case of IV mode of syringing or identify the region of interest in case of IM, ID, SC or neural block modes by means of a camera as well as the automatic positioning of the needle based on the ML algorithms for achieving syringing with minimized error and pain in mammals.

[0037] Figure 1 illustrates a system for identifying the accurate region of interest for syringing in a mammal according to an embodiment of the invention. The

system (**100**) comprises an automatic syringing system (**101**), an electronic controller (**102**), a mechanical controller (**103**), a selection unit (**104**), a positioning unit (**105**), a rotating unit (**106**), a syringing unit (**107**), a gripper (**108**) to hold a syringe along with a needle covered by a needle cap, a lighting source such as an IR lighting unit (**109**) along with a camera (**110**) to capture images, a processor (**111**), along with optional components such as a covering unit (**112**), a binding unit (**113**) and a display unit (**114**).

[0038] According to an embodiment of the invention, the automatic syringing system (**101**) is connected to the electronic controller (**102**), to receive one or more input parameters from one or more components of the system (**100**). The electronic controller (**102**) controls and signals the mechanical controller (**103**) for operating one or more mechanical components of the system (**100**). Further, the mechanical controller (**103**) operates to control the position as well as rotation of the syringe attached to the gripper (**108**) along with syringing procedures. The mechanical controller (**103**) provides one or more control parameters to the positioning unit (**105**), the rotating unit (**106**) and the syringing unit (**107**), and operates based on the user input provided to the selection unit (**104**) along with the data processed by the processor (**111**), based on the images captured from the region of syringing.

[0039] The input data for the selection unit (**104**) is fed through push buttons or remote control or by a mobile application or any Human-Machine Interface (HMI) to choose the mode of syringing. The details of the mode of syringing such as IV, IM, ID, SC, neural block etc., are selected using the selection unit (**104**). Subsequently, the input data fed into the selection unit (**104**) is communicated to the electronic controller (**102**), which further transmits the signal to the mechanical controller (**103**) to align the needle attached to the syringe by means of the positioning unit (**105**). The positioning unit (**105**) thus positions the gripper (**108**) holding the syringe and the needle based on the input data fed to the selection unit (**104**). For example, the needle has to be inserted into the blood vessel for an IV mode of syringing, the positioning unit (**105**) aligns the needle to

go through the midpoint between the walls of the blood vessel of the mammal, wherein such parameters are derived by the ML algorithm based on input parameters such as age, gender, Body Mass Index (BMI), body height, body weight, race, etc., provided to the system (**100**) while syringing. The ML algorithm configured to the system (**100**) computes the midpoint between the walls of the blood vessels, optimal depth for inserting the needle, etc., based on one or more input parameters provided to the system (**100**).

[0040] The IR lighting unit (**109**) is provided for illuminating the region of syringing and the camera (**110**) is provided to capture one or more images for identifying the blood vessel or any region of interest in the body of the mammal. The captured images are processed in the processor (**110**), which play a role in case the mode of injection is IV. Further, based on the images captured by the IR lighting unit (**109**) and the camera (**110**), the processor communicates to the automatic syringing system (**101**). The automatic syringing system (**101**) transmits one or more signals to the electronic controller (**102**). Subsequently, the mechanical controller (**103**) receives one or more signal from the electronic controller (**102**) for operating the positioning unit (**105**) and the rotating unit (**106**) to align and position the needle angle as per the configured ML algorithm. The rotating unit (**106**) rotates the syringe at the required angle, which is either specified directly through the selection unit (**104**) or accessed from the ML algorithm. The angle of insertion of the needle is the key point to avoid medical problems associated with the human errors. Hence, to avoid such errors during the identification of the accurate region of interest, the ML-based positioning aids in proper identification of the accurate region of interest as well as compute the angle and depth for syringing along with minimizing the error and pain while syringing.

[0041] Further, the syringing unit (**107**) operates the syringe by either injecting the medicine or withdrawing the blood or withdrawing the bodily fluid or fluid collections from the region of interest as per the requirement. The syringing unit (**107**) plays a vital role in minimizing the error and pain as it allows the insertion

of the needle in a controlled manner based on the ML algorithm, such that the needle is inserted at a slow speed as desired by the ML algorithm. Additionally, the syringe and the needle are placed within the covering unit (**112**) to minimize trypanophobia. The system (**100**) is further provided with the binding unit (**113**) comprising a strap, which is wrapped around the region of syringing on the mammal for better positioning of the system (**100**) during syringing. The automatic syringing system detects the accurate region of interest based on the mode of syringing in mammal, wherein the mammal includes human beings but can be extended to other class of mammals.

[0042] According to another embodiment of the invention, the covering unit (**112**) optionally comprises the display unit (**114**) and the selection unit (**104**) fixed on it. The display unit (**114**) displays the movement of the syringing needle to closely monitor the syringing process and is connected to the processor (**111**) during the automatic operation of the syringing system (**100**).

[0043] The invention discloses the system for detecting the accurate region of interest in mammals, wherein the mammal includes human beings but can be extended to other class of mammals. The system is operable in both automatic and semi-automatic mode based on the mode of syringing along with the degree of human intervention required.

[0044] Figure 2 illustrates a flowchart for a method to identify the accurate region of interest for syringing in a mammal according to an embodiment of the invention. The method (**200**) comprises a step (**201**) of binding the system at the region of syringing on the body of the mammal by means of a binding unit. At step (**202**), the needle cap is removed from the syringe placed within the covering unit. At step (**203**), the mode of syringing such as IV, IM, ID, SC, or neural blocks etc., is selected using the selection unit. At step (**204**), the IR lighting unit and the camera is focused on the region of syringing on the body of mammal to capture one or more images. At step (**205**), the images are captured by the camera with the IR lighting unit to detect the blood vessel or by means of the camera to detect the

accurate region of interest based on the mode of syringing selected in the selection unit. At step (**206**), the captured sequence of images are processed by the processor to identify the accurate region of interest. At step (**207**), the gripper is positioned as per the mode of syringing selected along with the input received from the mechanical controller to the positioning unit. At step (**208**), the gripper is rotated as per the mode of syringing selected in the selection unit and the ML based algorithm. At step (**209**), the syringing unit operates the syringe in a controlled manner to inject the medicine or withdrawal of bodily fluid or fluid collection from the body of the mammal as per the requirement based on the ML algorithm. At step (**210**), the motion of the needle during syringing is displayed on the display unit. Thus, providing a method for identifying the accurate region of interest for syringing by means of the IR lighting unit and the camera along with the ML based positioning for syringing. The ML based positioning is achieved by providing certain input parameters such as age, gender, BMI, body weight, body height, race etc., related to the mammal to derive blood vessel boundaries with wall thickness, the midpoint between the walls of the blood vessels and the optimal depth for syringing. The automatic syringing is achieved based on the data processed by the ML algorithm and the needle is positioned and rotated to an angle suitable for syringing and the needle is inserted accordingly. Thus, providing a method of syringing by means of an automatic syringing system.

[0045] Yet another aspect of the invention discloses a method of syringing in mammal by a semi-automatic mode. The method of syringing comprises removing the needle cap of the syringe placed within the covering unit, selecting the mode of syringing using the selection unit, rotating the gripper based on the input provided to the selection unit, injecting the medicine or withdrawal of bodily fluid or fluid collection from the body by means of the syringing unit and displaying the motion of the needle on the display unit. However, the system functions in a semi-automatic mode for identifying the accurate region of interest and injects the medicine or withdrawal of bodily fluids or fluid collection from the body of a mammal.

[0046] The system of the invention detects blood vessels using the IR lighting unit and the camera for syringing in IV mode or other accurate regions of interest for syringing in IM, ID, SC or neural block modes by means of the camera. However, identifying the region of interest may not provide the sufficient data for syringing and hence require additional parameters such as blood vessel boundaries with wall thickness, the midpoint between the walls of the blood vessels, the optimal depth to determine the extent of needle insertion along with adaptive control parameters such as controlled pushing of the needle into the blood vessel or other part of the body.

[0047] In order to achieve automatic detection and syringing based on the input parameters such as age, gender, BMI, body weight, body height, race, etc., along with control parameters such as blood vessel boundaries with wall thickness, the midpoint between the walls of the blood vessels and optimal depth are used to configure the system based on ML algorithm and to learn the control parameters especially the optimal angle, rate of syringing controlled pushing of the needle into the blood vessel or other parts of the body.

[0048] In the real scenario, when a mammal is subjected to syringing, based on the mode of syringing such as IV, IM, ID or SC, the input details mentioned above are obtained to derive the output control parameters. The automatic syringing is achieved based on the data processed by the ML algorithm and the needle is positioned and rotated to an angle suitable for syringing and the needle is inserted accordingly.

[0049] The ML algorithm allows accurate detection of blood vessel boundaries with wall thickness, compute midpoint between the walls of the blood vessels, thus minimizing damage to the walls of the blood vessel. Further, the adaptive control mechanism of the system, which allows controlled pushing of the needle within the blood vessel or body parts, results in minimizing the errors involved during syringing as well as minimizes pain.

[0050] The invention provides a safe syringing system to patients and health workers by avoiding the risk of blood borne diseases, along with minimal human error as well as fear of syringing by minimizing the pain, which may be hard to achieve by the conventional methods and the difficulties that arise while accessing the blood vessel in patients such as obese, lean, infants, etc. Therefore, the system allows automatic identification of the accurate region of interest and injects the medicine or withdrawal of blood from the blood vessel by IR imaging or thermal imaging. The system further identifies the accurate region of interest by means of a camera that may not require the IR lighting and processing feature to enable injecting the medicine or withdrawal of bodily fluid or fluid collection from other regions of interest for syringing in IM, ID, SC, or neural block modes. Additionally, the invention involves the ML-based positioning and control mechanism for automatic syringing by detecting the blood vessels or the accurate region of interest and provides accurate administration of the dosage.

Internal Ref: OR20C030

Claims:

We Claim:

1. A system for identifying the accurate region of interest for syringing in mammals, wherein the system (**100**) comprises:

    a. an automatic syringing system (**101**) to signal and control one or more components of the system (**100**);

    b. an electronic controller (**102**) connected to the automatic syringing system (**101**) to receive input parameters to perform and operate one or more functions of the system (**100**);

    c. a mechanical controller (**103**) connected to the electronic controller (**102**) for receiving the signal to control the position, rotation and one or more syringing parameters of the system (**100**);

    d. a selection unit (**104**) connected to the electronic controller (**102**) to select the mode of syringing in the mammal;

    e. a positioning unit (**105**) connected to the mechanical controller (**103**) to receive the signal from the mechanical controller (**103**) for aligning a syringe or a needle as per the accurate region of interest for syringing;

    f. a rotating unit (**106**) connected to the mechanical controller (**103**) to receive one or more signals for rotating the syringe;

    g. a syringing unit (**107**) connected to the mechanical controller (**103**) to operate the syringe for injecting the

medicine or withdrawal of bodily fluid or fluid collection from the body;

h. a gripper (**108**) connected to the rotating unit (**106**) and the positioning unit (**105**), wherein the gripper (**108**) holds the syringe with the needle covered by a needle cap;

i. a lighting source such as an IR lighting unit (**109**) for illuminating the region of syringing;

j. a camera (**110**) for IR imaging or capturing one or more images at the region of syringing;

k. a processor (**111**) connected with the automatic syringing system (**101**) for processing the captured images to identify the accurate region of interest;

l. a covering unit (**112**) attached to the gripper (**108**) to hold the syringe with the needle;

m. a binding unit (**113**) attached to the covering unit (**112**) comprising a strap to wrap it around the region of syringing; and

n. a display unit (**114**) to display the motion of syringing while operating the system (**100**).

2. The system as claimed in claim 1, wherein said selection unit (**104**) comprises set of push buttons or a mobile application or a remote control or Human Machine Interface (HMI) to choose the mode of syringing.

3. The selection unit as claimed in claim 2, wherein said mode of syringing at the region of interest such as Intravenous (IV), Intramuscular (IM), subcutaneous (SC), and Intradermal (ID) and neural blocks modes.

4. The system as claimed in claim 1, wherein the accurate region of interest comprises blood vessel or any part of the body for syringing.

5. The system as claimed in claim 1, wherein said system identifies the blood vessels for IV mode by IR imaging or identifies the accurate region of interest for IM, ID, or SC and neural blocks mode by means of a camera, wherein the system positions the needle by Machine Learning (ML) algorithms and an adaptive control mechanism to achieve syringing with minimal error and pain.

6. The system as claimed in claim 1, wherein said system is configured to function based on the ML algorithm using plurality of parameters such as age, gender, Body Mass Index (BMI), body weight, body height, race, etc., wherein such data are obtained to derive the output parameters such as controlled pushing of the needle into the blood vessel and to determine the midpoint between the walls of the blood vessel along with optimal depth for inserting the needle or controlled pushing of the needle into any region of interest for injecting the medicine or withdrawal of bodily fluid or fluid collection from the body in mammals.

7. The system as claimed in claim 1, wherein the system is configured to function in both semi-automatic and automatic mode.

8. A method for identifying the accurate region of interest for syringing in mammals, wherein the method (**200**) comprises:

    a. binding the system on the mammal by means of the binding unit (**201**);

    b. removing the needle cap of the syringe placed within the covering unit (**202**);

c. selecting the mode of syringing using the selection unit (**203**);

d. focussing the IR lighting unit and the camera on the mammal to capture one or more images (**204**);

e. capturing the images by means of the IR lighting unit and the camera to identify the accurate region of interest based on the mode of syringing (**205**);

f. processing the captured sequence of images to identify the accurate region of interest (**206**);

g. positioning the gripper holding the syringe as per the syringing mode selected and the input received from the mechanical controller based on the data provided by the processor to the automatic syringing system (**207**);

h. rotating the gripper based on the input provided to the selection unit along with the ML based algorithms (**208**);

i. injecting the medicine or withdrawal of bodily fluid or fluid collection from the body by means of the syringing unit (**209**); and

j. displaying the motion of the needle on the display unit while syringing (**210**).

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Abstract

A system for identifying accurate region of interest for syringing in mammals and method thereof

[0051] The invention discloses a system to identify the accurate region of interest for syringing in mammals using thermal or Infrared (IR) imaging along with Machine Learning (ML) based needle positioning to automatically inject the medicine or withdrawal of bodily fluid or fluid collection from the body. The system comprises an automatic syringing system (**101**), an electronic controller (**102**), a mechanical controller (**103**), a selection unit (**104**), a positioning unit (**105**), a rotating unit (**106**), a gripper (**108**), a syringing unit (**107**), a lighting source such as an IR lighting unit (**109**), a camera (**110**) a processor (**111**), and a covering unit (**112**). The invention also discloses the method for identifying accurate region of interest for syringing in mammals. The system is useful to minimize human errors thus reducing pain during syringing.

(FIGURE 1)

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