HUMANOID CARE ROBOT FOR NURSING HOME IN SRI LANKA

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***Abstract*— Humanoid Care robots are used in hospitals and houses to care for and assist inclined human beings, which includes the aged, children and those with physical and intellectual disabilities. The paper has two predominant objectives such as have a look at the challenges springing up from the use of elderly care humanoid robots at nursing homes as well as to discuss how the layout of elderly care humanoid robots can deal with these challenges. To recognize higher the real-global capability of robot-based assistance, we undertook a case study in a nursing home involving agencies of elder citizens, caregivers and managers as stakeholders. We identified each, enablers and barriers to the ability implementation of robotic structures. Development approaches are data information collected to propose the model, the proper way to interconnect electronic components, practical limitation, system tasks, functional system research, sample system design. This article evaluates the introduction of the new humanoid system and its background, explains the literature review, theoretical approach, methods resources used, activities carried out for the research methodology. achievements and methods adopted to meet these objectives, the design and implementation and final design of the system.**

Keywords: Autonomous Mobile Robots, Nursing Home, Elder care, Humanoid Robot

I. INTRODUCTION

The Humanoid Robot usage is dramatically increasing inrecent years in Health Care sectors. The wheeled machines can initiate rudimentary conversations, play favorite music, teach languages, and supply sensible facilitate.
The predicted model objective is to design a Humanoid Robotic system for Nursing Homes to beat problems.
Following objectives are considered to be achieved by proposing an appropriate Humanoid Robotic system for Nursing Homes.

- To identify expected features from data collected from Nursing Homes / Care Centers
- System should be designed to look at the elders.
- To design a system which will be wont to send information about the robotic location where operator can easily identify.
- To embrace human-robot interaction skills like face recognition, speech and gestures

II. OVERVIEW

A. XYZ Nursing Home Visit

Management and the Staff that care for Elderly want from a Humanoid Robot, and how AI could bridge the widening gap between the number of Elderly in need of careand the number of Professionals available to care for them

Supporting Human Care Workers without taking theirjobs, and reliably attends to the social, emotional, and physical needs of aging people in a way that respects theirdignity and privacy.

B. A Nursing Robot System for The Elderly and The Disabled by H.K. Park et.al. [1]

The developed system is called: DO-U-MI. It is designedto assist elderly and disabled people in nursing operations. Inputs to the robotic systems could be classified as follows.

1. The cameras and microphones equipped in the robot help the robot recognize environments.
2. Two color cameras in the head of the robot help to detect and track the human face and make the robotapproach the user for services.
3. Two microphones receive sound and localize the sound source. If a person wants to be served by the robot, he can notify the robot by clapping his hands.

Power to the motors is supplied from batteries integrated into the robotic system. The robot consists of sensory arrays which help the robot to be operated in a safe environment always. The ultrasonic sensor can detect long-distance obstacles and the infrared sensor can detect very close obstacles.

The main computer is utilized in the system is a PentiumIII-866MHz central processing unit. Liquid crystal monitor displays the information from the computer and the touch control enables user inputs to the system with a touch command via the liquid crystal display.

The face recognition operation is performed as a part of the man-machine interface integrated into the robotic system.

C. Nursing and rehabilitative care of the elderly using humanoid robots by T. Tanioka et.al. [2]

Clinical trial outcomes using a PEPPER robot based onthe Transactive Relationship Theory of Nursing (TRETON)

is explained in this scholar. The TRETON explain three major processes which could be classified as characteristic activities and influential among healthcare providers, humanoid robots and elders with dementia.

Several measurements related to system inputs could be contrasted in this system as follows.

- Heart rate of the patient
- Low frequency/High-frequency ratio.
- Coefficient of variation of R-R intervals
- High-frequency power.
- Movement (Acceleration strengths)
- NU (sympathetic-parasympathetic balance)

Pepper robot consists software modules which could be categorized as key modules of its system to use for cognitive operations [3].

D. Typical applications and feature of commonly used humanoid robots in the industry by A. Choudhury et.al. [4].

Healthcare practitioner and benefactors have appreciated the advantage of advanced surgical robots. However, our study highlights the application of humanoid robots and their roles in healthcare. In addition to surgical robots, healthcare humanoid robots have been successfully helping people in disease management, pain relief, pediatric healthcare assistant, and physical therapy. The role of healthcare robots can be broadly classified into clinical and non-clinical applications.

E. Robot-Guided Exercise Program for the Rehabilitation of Older Nursing Home Residents by I. Back. et.al. [5]

Two basic types of robots could be utilized in humanoid nursing and caregiving operations as follows,

1. Socially interactive robots

Socially interactive robots communicate with the user through social and nonphysical interaction.

2. Assistive robots

Assistive robots assist the user, such as by performing a physical task that the patient or caregiver is unable to perform.

A system inbuilt software is provided with the NAO robot to install development libraries and frameworks by Softbank robotics. Choregraph is the programming software that allows NAO developers to edit and create movements in a simple user interface (UI). The predefined library is named as NAOqi.

Also, 'NAO Controller' is a customized Android application that was developed by R. L. Brown et.al. to control the robot using a mobile application. Which gives the user better reliability and ease of user experience.

F. Development of a Tele-Nursing Mobile Manipulator for Remote Caregiving in Quarantine Areas by Z. Li. et. Al. [6]

This system was developed to be utilized to reduce the exposure to highly infectious patients of nurses, EMTs and aid workers in the healthcare sector.

Tele-Nursing robot is developed by Li. et.al. in this scholar using a Baxter robot from rethink robotics technologies. This strategy is named as Tele-Robotic Intelligent Nursing Assistance (TRINA) mobile manipulator. It focused on the following system specifications as well.

- Human-safe system
- Versatile
- Usability by novice users
- Rapidly assembled.
- Relatively inexpensive

The developed project (TRINA) has been able to meet the following system requirements.

- Mobility in a hospital room or ward (no stairs)
- Capability of light- to medium-duty tasks (< 1hr
- Continuous, 24hr operation
- Cost < $100,000

Input commands from the input devices are relayed to the operator console. It communicates with the robot through the system state service.

The controller dispatcher listens to the posted tasks and launches a task-specific controller and commands to the motion server afterwards. ROS framework is used to stream the following information to the system.

- Sensory feedback
- Videos from different cameras
- 3D display of the robot's cognitive map

G. Development of a Nursing-Care Assistant Robot RIBA That Can Lift a Human in Its Arms by T. Mukai et.al. [7]

This development focuses on the lift-in operation of bedridden patients by a RIBA robot. Because it is one of the most physically challenging tasks in nursing care. RIBA has human type arms that were designed to perform heavy physical tasks which require human contact. For this operation, cooperation between the caregiver and the robot is required.

The following priorities have been set forth by the authors in decreasing order of importance.

- A payload that enables the robot to lift a human(over 60 kg)
- A size that allows RIBA to move into small spaces(width less than 80 cm)
- A joint speed as high as possible while satisfyingconditions

RIBA is involved in lifting a human from a bed, placing a human on the bed, lifting a human from a wheelchair, putting a human down on a wheelchair and moving with a human in its arms.

III. METHODOLOGY

Human-care robots in nursing homes involve in precise operations such as medicine handling, patient care and nursing assistance etc. In an overall basis, these robots are specialized to perform several users defined tasks with respect to the requirements of different operational environments. Two prominent interfaces could be integrated

with regard to the requirement of the application of nursing home robots.

1. The user and feeds input commands to the controlled system and interacts with the user/patient.
2. Located away from the user which integrates technical manipulators and operations according to the user inputs to the system.

A. Optimum Design

The design which was selected as the optimum design (Fig.-1)

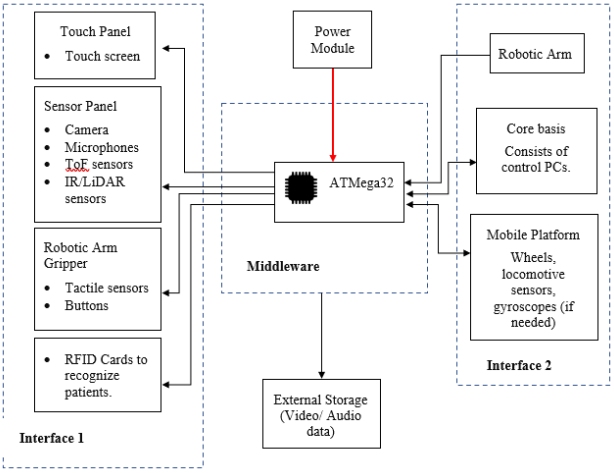

Fig. 1. Block Diagram for Optimum Design

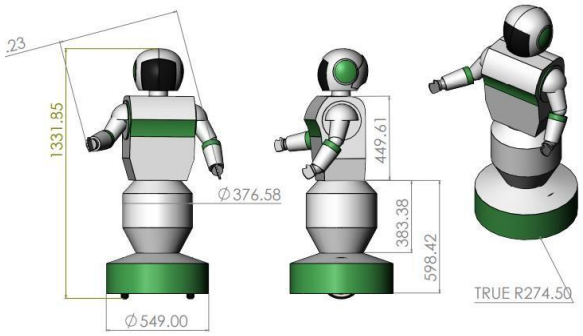

Fig. 2. Mechanical Design of Humanoid Robot

Proposed Optimum Design consist of several subsystems as follows

1. Mobile platform performance and manipulation.

The robot control integrated with a preferred number of wheels. Ideal number of wheels which are integrated as a suggestion in this solution is four. The wheeled drive was preferred to legged locomotion because of safety (no risk of falling) and stability during manipulation. Laser scanners or other locomotive sensors could be integrated to the mobile robot platform for navigational tasks. Robot body contains the sensor carrier, manipulator and the tray. It contains the PCs and other electronic components necessary for robot control. Specifically for the robot arm, any kind of state of the arm robotic arm could be integrated or, the arm can be designed and implemented according to user requirements as well (Specially the number of DOF and the maximum load to be carried by the arm).

2. Sensor panel.

Sensor panel consists of cameras and 3D time of flight camera sensors to identify, locate and track objects and humans in a 3D space. This could be mounted on to the robotic arm or a separate platform on the mobile robot platform as well.

3. Human interaction operations:

Human interaction mainly focusses on the followingtasks to be executed successively according to provided information/inputs from the user.

1. Accept user command
2. Move to target position
3. Locate desired object
4. Grasp object
5. Bring object to user

In order to execute the above-mentioned steps, safely navigation among humans, object learning and detection and object manipulation could be performed successfully.

4. Path planning of the mobile robot platform:

Path planning could be tackled through a preferred path planning algorithm such as A* among various path planning algorithms utilized in the industry. Once again, the utilized path planning algorithm could also be changed in accordance with the robot path environmental conditions and the behavior of existence of natural obstacles on the map.

- Controlling the motion:

Motion control system could be split into three categories considering the ease of manipulation of controller commands as follows.

a. Trajectory planning controller.
b. Controller to coordinate four wheels.
c. Third controller for individual wheels.

- Object identification and detection

For object grasping, the robot must detect the object first. This is performed by the camera mounted on the sensor panel of the robot with the range imaging sensor. A special calibration between the sensors is used to compute an approximate color image of the captured image from the camera.

The resulting image provides not only the color value, but also the distance of respective neighborhood points in the surrounding environment for each pixel in the captured image.

This method could be integrated for object detection and image processing operation of the system.

IV. TESTING AND EVALUATION

In general, a humanoid robotic system growing in an unpredictable environment is made up of software and hardware components such as sensors, actuators, communication ports, drivers, control rules, and so on. Most of the time development takes a code-centric approach, limiting reusability due to the unique characteristics of the hardware, the environment, and the robot mission.

TABLE I. TESTING TYPE AND EVALUATION FACTORS

Testing Types	Evaluation Factors
Manual Control Test	Navigation
	Remapping
	Manual arm movement
	Manual head movement
	Forward/ Backward/ Right/ Left
Fleet Management System Test	Teleconference
	sound system
	Navigation
	Command (play movie)
	Obstacle avoidance
	Connecting to Fleet Management System
	Dashboard
ROS Test	Saving Map
	Loading Map
	SLAM
	Navigating via SLAM
Application Test	Registration
	Temperature recording
	Exercise videos
	Quiz
	Feedback
	Teleconference
	News
Hardware Test	Battery
	Wheels
	Sound system
	Display
	Central Processing Unit
	Wiring

V. CONCLUSION

Humanoid robots have important applications in nursing home. The majority of study in all of these sectors focuses on the impact of utilizing a humanoid robot, as well as user acceptance and trust in the robot. According to the extant literature, people's attitudes toward the use of humanoid robots differ from one person to the next.

As a result, the key target of this paper is to introduce a New Humanoid Robot for selected Nursing Home.

A. Limitation

Humanoid Robots cannot offer the selflessness and compassion that ought to be at the core of a caring system. Humanoid Robots may even increase loneliness within the long run by reducing the particular contact individuals have with humans, and by increasing a way of disconnect.

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