IoT based Assistive Robot for The Alzheimer's Patient using AI

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***Abstract*— In this modern world, there are many technologies that are emerging day to day but no such technology is being efficiently and economically used to the Alzheimer's person in terms of their safety. In this paper, the design of an autonomous robot is proposed which can detect and identify any object. A central processing unit using Arduino UNO will take sonar sensor input and control the motor drivers to move freely. Artificial intelligence technology integrated with an image processing unit that will be able to remember its owner and track objects. The cameras and microphones will be equipped in the robot to help the robot recognize environments. This mechanism in the robot will allow helping an Alzheimer's person inhouse work. The proposed design is implemented and successfully verified through commanding to accomplish different work.**

I. INTRODUCTION

An assistive device is a device that can be helpful for humans especially for older, Alzheimer's people. It is beneficial for their daily activities, like helping them to identify the object and places. Assistive device which will help to find objects, open doors, and follow your routine. Their system of life and living has changed in many different ways, meaning they must endure a process of adjustment and self-evaluation.

II. LITERATURE SURVEY

A. DESIGN OF A CONTACT ASSITIVE ROBOT FOR THE DISABLED, ELDERLY, AND INFIRM PEOPLE: CASE FOR DEVELOPING COUNTRIES [SAKET S. CHATURVEDI et al, 2019]

The use of a wheelchair for normal routines or rehabilitation has various physiological and psychological implications. The use of contact assistive robots in developing countries is limited mainly due to their expensive nature. The benefits of exoskeleton use include health improvement, increased self-dependency, and self-sustenance. The chapter offers a solution through the design of a cheap contact assistive robot for the disabled. The design procedure includes the integration of acquired knowledge on gait training and existing exoskeletons acquired from intense research, visits to rehabilitation centers, and use of computer-aided software for design and simulations. A fully functioning scaled prototype was made that demonstrated the operating principle of the actual design. The design provides a successful baseline for further development of exoskeletons suitable and cheaper for developing countries with an initial estimated total material cost of USD$9000.

B. DESIGN AND IMPLEMENTATION OF ASSISTIVE ROBOT FOR THE ALZHEIMER'S PERSON

In this paper, the design of an autonomous robot is proposed which can detect, search, pick up and drop any object. A central processing unit using Raspberry Pi will take sonar sensor input and control the motor drivers to move freely. Artificial intelligence technology integrated with an image processing unit that will be able to remember its owner and track objects. Four motorized wheels that can be controlled by the user or the robot itself make the robot move to any direction or place. The cameras and microphones will be equipped in the robot to help the robot recognize environments. This mechanism in the robot will allow helping Alzheimer's person inhouse work the proposed design is implemented and successfully verified through commanding to accomplish different work.

C. DESIGN AND IMPLEMENTATION OF HEALTHCARE ASSISTIVE ROBOT- MAJID A. AL-TAEE, NABEEL A. AL-SABER, OMAR B. KHADER

The proposed work in this paper mainly focuses on the design and development of the assistive robot for the disabled and the patients in need. This work addresses the challenges of the robotic field to improve the supply of health care services to patients in the upcoming development. The assistive robot developed in this work includes both hardware and software design. The combination of the IR sensors, real time clock (RTC) and microcontroller manages the overall operation of the system. Hardware includes grippers with flexible arm which is used to pick and place operations and the sensors are used for the detection of an action. IR sensors are used for obstacle detection, range determination and obstacle avoidance. In order to validate the designed hardware and software a case study of assisting the bed ridden patient by delivering medicines on time is considered so that more importance is given to nursing care residents. Experimental results demonstrated its proper functioning by delivering prescribed tablets by automatically moving towards the patient as per the timeline indicated in real time, which is demonstrated using developed prototype model.

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III. EXISTING SYSTEM

A robot prototyped in 2013 was developed to similarly identify steps, and intervene as needed, in the process of making tea. Though most of the participants in this study had the cognitive capacity to complete the task themselves, most subjects and their caregivers reported interest in the robot, noting that it was useful, and would be nice to have at a later stage of the subject's disease .other implementations of this paradigm include nurse bot and the auto minder system.

Another area of considerable interest for applying robotics to dementia care comes in the form of cognitive assistive robots and technologies that aid users in performing activities of daily living. Such devices typically have roles in helping patients to maintain a schedule and remember certain tasks. More complicated models use computer-vision to determine what the user is trying to do, and prompt them to perform the task correctly. One example is the "coach" system that was designed to assist dementia patients with handwashing. The system is capable of recognizing handwashing steps, as seen through a camera, and prompts the user with audio and shows video demonstrations as necessary.

IV. DEVELOPMENT OF ASSISTIVE ROBOTS

Many assistive robots for elderly and disabled people have been developed in the past few decades. However, very few of them became commercially available. The major cause of the problem is that the cost-benefit ratio and the risk-benefit ratio of them are not good or not known. The evaluation of them should be done in the light of the impacts of assistive technologies on users' whole life, both in short-term and long-term. In this paper, we propose a framework of evaluation and design of assistive robots using ICF (International Classification of Functioning, Disability, and Health). The goal of the framework is the realization of the life design and the improvement of the quality of life using assistive technologies. We describe the concept of utilizing ICF in the development process of assistive robots, and demonstrate its utility by using some examples of practical application such as the analysis of daily living, the design of assistive robots and the evaluation of assistive robots. We also show the issues of using ICF for further development of the framework.

There are growing needs for assistive robots which support independent life of elderly and disabled people or help people who work at the assistance and the nursing care. Although a great number of assistive robots, for example, wheelchair robots, walking assist robots, upper-limb assist robots, communication robots, and so forth, have been developed in the past few decades, very few of them became commercially available. We believe the major cause of the problem is that the cost-benefit (or risk-benefit) ratio is not good or not known. Cost, risk, and benefit are three important evaluation axes of assistive robots. They are contradictory criteria, so getting full points on all the evaluation axes at the same time is difficult. Therefore, quantitative evaluation of them and the trade-off among them are indispensable. In the case of industrial robots, the cost-benefit is comparable between the robots and the human workers, since the role of robots is simply to substitute for the human work. Also, in the case of assistive robots, we can estimate the cost, comparing the robots and the labor cost of care staffs. However, the appropriate evaluation of assistive robots is difficult unless we can estimate objectively and quantitatively the contribution of them to the improvement of QOL (quality of life). Note that the benefit of the robots here is not merely the performance as an assistive equipment, but the advantageous effect on the user and the user's life.

For the risk of the assistive robot, an international standardization of the safety of assistive robots is being promoted in a promising project "Project for Practical Application of Service Robots" (NEDO, FY2009–2013). However, the "risk" of being dealt with in this project is limited to the safety issues of mechanical/electrical aspects of the hardware. Other risks caused by use of assistive robots are not considered, for example, the risk of a disuse syndrome which is the reduction of activities derived from excessive assistance by robots.

The evaluation of cost-benefit and risk-benefit should be done in the light of the impacts of assistive technologies on users' whole life, both in short-term and long-term. This needs a sharable and exhaustive description language for robot and human, which covers a wide range of human life. International Classification of Functioning, Disability, and Health (ICF) which was approved by the World Health Organization (WHO) in 2001 is suitable for this purpose. In this paper, we propose a framework of development of assistive robots using ICF, which includes the evaluation of the assistive technologies in users' life.

V. DISADVANTAGES

1. The assistive robot can be divided into several categories. The first group for the assistive robot is rehabilitation robots. The primary purpose of this was based on physically assistive technologies like smart wheelchairs. In 2005, artificial limbs and exoskeletons also added to this category.
2. There are also two types of social robots: Service Robot and Companion Robot. There are many assistive robots for elderly and disabled people Care-O-Bot.
3. Artificial intelligence robot AIBO also introduced later on. Companion robots are made for an elderly person to increase health and psychological support.
4. There are not any precise definitions or surveys for assistive robotics but it can be described by emphasizing the importance of social interaction on socially assistive robotics as the meeting point of assistive robotics and socially interactive robotics and also stated that this kind of robot has the purpose of aiding humans in the process of providing specific assistance.

VI. PROPOSED SYSTEM

The proposed work in this paper mainly focuses on the design and development of the assistive robot for the disabled and the patients in need. This work addresses the challenges of the robotic field to improve the supply of health care services to patients in the upcoming development. The assistive robot developed in this work includes both hardware and software design. The combination of the IR sensors, real time clock (RTC) and microcontroller manages the overall operation of the system. Hardware includes grippers with flexible arm which

is used to pick and place operations and the sensors are used for the detection of an action. IR sensors are used for obstacle detection, range determination and obstacle avoidance. In order to validate the designed hardware and software a case study of assisting the bed ridden patient by delivering medicines on time is considered so that more importance is given to nursing care residents. Experimental results demonstrated its proper functioning by delivering prescribed tablets by automatically moving towards the patient as per the timeline indicated in real time, which is demonstrated using developed prototype model.

VII. ADVANTAGES

1. With massive improvements in healthcare and lifestyle in the last century, people are living longer.
2. While longevity is an important achievement of modern-day, it does present challenges in terms of caring for an increasingly elderly population.
3. The issue of elder care is one of supply and demand. As the elder population increases in numbers, the number of caregivers is not correspondingly increasing.

CONCLUSION

This review has identified and synthesized the breadth of evidence on the barriers and facilitators to the implementation of social robots for older adults and people with dementia. Future research should pay more attention to investigating the contextual factors, using an implementation framework, to identify barriers and facilitators to guide the implementation of social robots.

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