

Robotics in Sri Lanka: Current Status and Future Potential

W.S.S.Perera¹ and Prabodha Lenora²

¹Faculty of Graduate Studies & Research, Sri Lanka Institute of Information Technology, Malabe, SRI LANKA

²Faculty of Graduate Studies & Research, Sri Lanka Institute of Information Technology, Malabe, SRI LANKA

¹Corresponding Author: shashipraba.56@gmail.com

ABSTRACT

Sri Lanka is a technological leader around the globe. As a result, Sri Lanka's software sector is conducting several trials with Artificial intelligence, machine learning, and the Internet of Things. This study places an emphasis on the application of artificial intelligence in a major domain, robotics, which will have a significant impact in Sri Lanka in the near future. Starting from an introduction to the robotics domain in Sri Lanka, we discuss what is robotics, the impact of robotics in the world, and Sri Lanka in brief. This paper examines the current state of robotics in Sri Lanka, with a focus on its potential for economic and technological development. We review the existing research and development initiatives in robotics and identify the key challenges and opportunities facing the field in Sri Lanka. We also discuss the potential applications of robotics in various sectors, including manufacturing, agriculture, healthcare, and education. Through a review of the literature and interviews with industry experts, we aim to provide a comprehensive overview of the current state and future prospects of robotics in Sri Lanka. The most important and popular robotics implementations are selected and further analyzed. Then the significance and contribution of those two studies to robotics are analyzed with advantages and disadvantages for robotics domain in Sri Lanka. Next, the technologies and key algorithms are discussed in light of recent research. Finally concludes with future works and robotics barriers in Sri Lanka.

Keywords-- Artificial Intelligence (AI), Humanoid Robot, Natural Language Processing (NLP), Diyazen, Brain Computer Interface, CNN, EEG

I. INTRODUCTION

Robotics is an artificial intelligence domain concerned with the development of intelligent and efficient robots. It is in the field of social robotics that these technologies are brought together to create human-friendly and human interactive robots that improve the lives of ordinary people easier.

Automation in every field will boost productivity and lead to technical improvements in a developing country like Sri Lanka. Companies would be able to increase production by up to 85% with the introduction of robotic systems. Regardless of size, robotic technology can improve all aspects of task-based organizations [1].

Despite these early conceptions and portrayals, the robotic revolution began in earnest in the 1950s. In

1954, American inventor George Devol built Unimate, the first digitally controlled and programmable robot. The contemporary robotics industry was built on this foundation. Following that, many crucial and massive breakthroughs in the history of robotics occurred, leading to the development of current commercial and industrial robots [2].

According to the recent studies we have selected two of the most popular research and implementations of Robotics in Sri Lanka. One of them is Diyazen which is a technologically advanced innovative humanoid innovation. The second study is a Sorting hat which was brought to real life and designed to not only "read" the wearer's thinking and place them in a House, but also to examine the brain for medical reasons.

II. DIYASEN - A TECHNOLOGICALLY INNOVATIVE HUMANOID INNOVATION

Sri Lanka's software sector is conducting several trials with Artificial intelligence, Machine learning, and the Internet of Things. Consequently, Sri Lanka developed the country's first humanoid robot, "Diyazen," which has gained widespread popularity in the worldwide software business. On the other hand, it is South Asia's tallest robot. We shall explore the "Diyazen" in this article. In Sri Lanka, it is yet a growing robot.

Many of Diyazen's skills come from the Arimac Cognitive Platform, which is an ultra-modern virtual assistant. A variety of talents are available, including natural language processing and discourse management. Diyazen is a technologically advanced humanoid robot that is equipped with Robot Operating Systems, which enable it to perform localization, path planning, and mapping tasks. It has the ability to build 2D environments and can recognize faces and understand emotions. It also has natural multilingual processing capabilities, which are useful for customer relations. Additionally, it has multi-sensory alert systems and a long battery life, making it suitable for use in industries such as logistics and those that involve human interaction.

As a result, it is designed to meet the needs of a wide range of users. To meet the ever-increasing demands of the business sector, Diyazen is always being improved.

III. HARRY POTTER SORTING HAT

Magic is something we truly love to have in our actual lives. As a realization of our desire, the University of Sri Jayawardanapura has built a Harry Potter sorting hat. This headgear can read minds and assign pupils into different houses, exactly like in the Harry Potter movies. That's not it. It can study brain activity for several additional medical and scientific uses. Children are linked to these sorts of imaginary characters; thus, these robots enable us to contact them with children's brain functions. The Sorting Hat robot is largely focused on autistic youngsters. Instead of comprehending the feelings of autistic children, he would convey their emotions on their behalf. This hat acts as a bridge between autistic children and their classmates because it allows them to express their feelings.

The hat acts as a mediator, bridging the communication gap. This hat is advised for usage in residential settings or situations where children interact. Additionally, it has an EEG sensor that records raw brain wave data for later cognitive study. To create an equivalent and lightweight wearable robot, a comparable fabric material was employed, the skeletal components were 3d printed using accurate weight measurements, the facial emotions were mapped frame by frame, and the character voice was manually recorded [3].

IV. ADVANTAGES AND DISADVANTAGES

A. Advantages

One of the most important aspects of robots is that they are able to learn from and mimic human behavior [2]. Robots may boost output, efficiency, quality, and consistency in a variety of ways: Robots, in contrast to humans, never get tired of doing the same thing over and over again. For as long as they last, they'll be able to perform the same thing again and over.

B. Disadvantages

For this to be a success, a significant amount of money and knowledge on humanoid robots is required. When it comes to energy usage, most modern robots are abysmal. There has been little progress in the development of robot power sources. Power generating and storage methods haven't changed much since these robots were first introduced decades ago. Robotic

batteries are often unreliable and dangerously short-lived.

V. TECHNOLOGIES AND KEY ALGORITHMS USED

According to the study [4], Diyazen's natural multilingual processing enables it to comprehend Sinhala, English, Tamil, and mixed-language instructions. A robot will react to touches and will move its head in the direction of the touch or speech. Diyazen is a highly user-friendly application. It has a distinctive appearance and a height of around 4.5 feet, which makes it very useful for connecting with people. Diyazen's responsibilities include issuing tickets and assisting individuals with their requirements.

When equipped with Robot Operating Systems (which allow for localization, route planning, and mapping), Diyazen can create 2D worlds. This robot has been designed to detect faces and comprehend human emotions as well as its technical capabilities. Diyazen has been built with a cognitive environment that is a match for worldwide humanoid robotic breakthroughs, including natural language processing. Diyazen's 10-hour battery life and multi-sensory warning systems enable it to be used not just in the logistics business, but also in fields that need human interaction.

According to study [3] In order to create an interactive social robot, the following design approach was performed.

- 1) Structural development
- 2) External aesthetic design
- 3) Design of the interface
- 4) Integration of the EEG sensor
- 5) Experiments with non-autistic users
- 6) Acceptance studies of autistic users

Facial expressions of a robot. The primary stimulus for interacting with this robot is the exhibition of situation appropriate 12 facial expressions. Facial emotions such as pleasure, sorrow, and rage are used to provide a unique method for user engagement.

A. Natural Language Processing

Artificial intelligence (AI) is a discipline of computer science that deals with providing computers the capacity to interpret text and spoken words in much the same way that humans can. Natural language processing (NLP) relates to this branch.

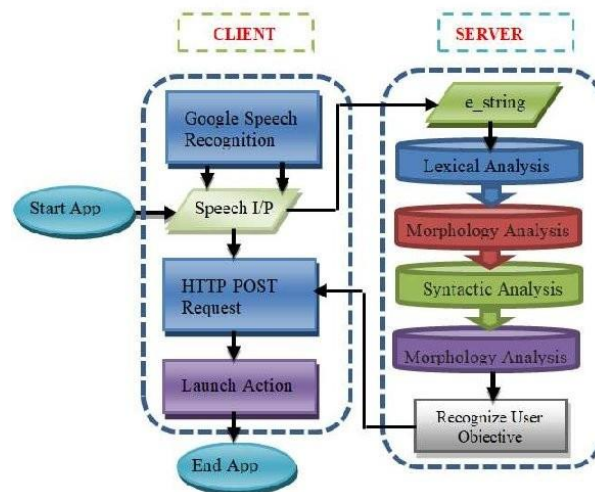


Figure 1: Natural language processing data flow diagram in man-machine interface [5]

To better understand the grammatical structure of sentences and the underlying meaning of individual words, natural language processing breaks down spoken material into smaller chunks. Human-like comprehension of spoken or written language is aided by this technology.

In many downstream applications, such as voice recognition Figure 1 or text analytics, NLP helps resolve ambiguity in language and provides helpful quantitative structure to the data [2].

B. EEG Integration

Robots may be controlled by brainwaves using the noninvasive Brain Robot Interaction (BRI) technology, which employs the electroencephalogram (EEG) based Brain Computer Inter-face (BCI).

As we have shown with autistic youngsters, this technology has potential for assisting older or handicapped patients with everyday activities. The primary objective of a BRI system is to decode brainwaves obtained via EEG equipment to detect human mental activity.

Due to its cheap cost and mobility, an EEG device as a representative of noninvasive technology has found widespread use in both clinical and research settings [6].

C. Brain Computer Interface

This might enable humans to move a robotic arm in just the same way they control their other limbs or convey data about the hue of an item to those portions of a brain that interpret color, allowing those with visual impairments the ability to see again. Non-Invasive Brain-Computer Interface and Invasive Brain Computer Interface are two types of BCI. Because technology enables paralyzed people to operate their prosthetic with their thoughts, Brain Computer Interface has several advantages. Send pictures to a blind person's brain so they can see again. A deaf individual can now hear again thanks to the delivery of auditory input to their brains through this method.

D. CNN based high-speed semantic analysis technology

Picture segmentation is a method that divides an image into multiple distinct parts, each of which has its own distinct properties, then extracts the specific items of interest from each of these sections. In remote sensing image study, image semantic segmentation technology can segment and label certain targets in order to extract specific information.

Semantic segmentation of remote sensing images may help advance military, agricultural, environmental, and other critical study fields with its findings [7].

VI. FUTURE POTENTIAL AND BARRIERS

The next generation of robots, which will use artificial intelligence and automation to expedite tasks currently handled by human workers, will dramatically disrupt the job market, as previous technological advancements have done. To make it easier for us to work with robots, robotic engineers are developing the next generation of robots to look, feel, and act more human. Robots will be able to react naturally in their environment thanks to realistic-looking hair and skin with embedded sensors. A robot that detects your touch on the shoulder and turns to greet you, for example [2].

Robotics domain would be the perfect way to go for a country like Sri Lanka, which is looking at a quick rate of development while also wanting to implement cost-effective, yet efficient technology, especially for the Small and Medium-Sized Enterprises, which make up a large part of the business eco-system [1].

High upfront costs are one barrier that can occur anytime in the present or the future. Instead of sticking with old, manual methods, investing in

automating production processes can be more cost-effective over time. But in the next 10/15 years, this technology will only expand in importance. To get a long-term return on investment, this type of technology needs to be seen through a long-term lens. Also, designers of robotic and AI systems should take ethical considerations into account, and autonomous systems must be aware of the ethical consequences of their behavior.

VII. DISCUSSION

That being said, it is likely that robotics technology has made significant progress in Sri Lanka since 2021, and is being applied in various sectors such as manufacturing, agriculture, healthcare, and education. It is also possible that there have been developments in the research and development of robotics in the country, and that there are ongoing initiatives to promote the adoption and integration of robotics technology.

It is difficult to predict the exact future of robotics in Sri Lanka, as it will depend on a range of factors such as technological advancements, economic conditions, and government policies. However, it is likely that robotics will continue to play a significant role in the country's economic and technological development.

Robotics technology has the potential to improve efficiency, reduce costs, and increase productivity in various sectors, including manufacturing, agriculture, healthcare, and education. It can also facilitate the creation of new products and services, and help Sri Lanka to compete in the global market.

In order to realize the full potential of robotics in Sri Lanka, it will be important to invest in research and development, and to create an enabling environment for innovation. This may involve the development of policies and regulations, the creation of partnerships between academia and industry, and the provision of training and education programs. By taking these steps, Sri Lanka can position itself as a leader in the field of robotics and create new opportunities for economic growth and development.

ACKNOWLEDGMENT

We would like to express our gratitude to the coworkers for their support in keeping us on the schedule. We would like to conclude by thanking our lecturers for their unwavering support and encouragement throughout the academic career.

REFERENCES

- [1] "The collaborative robot revolution reaches sri lanka," www.universal-robots.com. [Online]. Available at: <https://www.universal-robots.com/about-universal-robots/news-centre/universal-robots-launches-in-sri-lanka/:text=In%20a%20developing%20economy%20like>.
- [2] "Robotics: Background, influence on everyday life and future," 2022. [Online]. Available at: <https://www.dailynews.lk/2020/07/28/finance/224422/robotics-background-influence-everyday-life-and-future>.
- [3] "What is natural language processing," MonkeyLearn Blog, 02 2020. [Online]. Available: <https://monkeylearn.com/blog/what-is-natural-language-processing>.
- [4] Arimac, "Diyazen - a revolutionary humanoid technological innovation," Arimac, 09 2020. Available at: <https://medium.com/teamarimac/diyazen-a-revolutionary-humanoid-technological-innovation-f8a6d65a3882>.
- [5] S. Singh. (2019). The role of speech technology in biometrics, forensics and man-machine interface. *International Journal of Electrical and Computer Engineering (IJECE)*, 9, 281.
- [6] X. Mao, M. Li, W. Li, L. Niu, B. Xian, M. Zeng, & G. Chen. (2017). Progress in eeg-based brain robot interaction systems," *Computational Intelligence and Neuroscience*, 2017, 1–25.
- [7] M. Alam, J.-F. Wang, C. Guangpei, L. Yunrong & Y. Chen. (2021). Convolutional neural network for the semantic segmentation of remote sensing images. *Mobile Networks and Applications*, 02.
- [8] P. Asanka, H. Fernando, T. Adhikari, I. Pathirage & A. Karunananda. (2014). State of artificial intelligence in sri lankan software industry. *IJIRT*, 1, 9–16.
- [9] M. Thushari, "Diyazen – sri lanka's first humanoid robot," DEV Community. [Online]. Available: <https://dev.to/ucscmozilla/diyazen-sri-lanka-s-first-humanoid-robot-1lpg>.
- [10] Codingest, "The first humanoid robot of sri lanka," Digital Mantra, 08 2020. [Online]. Available: <https://www.digitalmantra.lk/first-humanoid-robot-sri-lanka>.
- [11] G. Premathilake. (2020). Value of robots: A literature review. Ph.D. *Dissertation*.
- [12] Hilma, "Sri lanka's first-ever humanoid robot, diyazen to take up duties at lotus tower — asian truth." Available at: <http://www.asiantruth.com/sri-lankas-first-ever-humanoid-robot-diyazen-to-take-up-duties-at-lotus-tower/>.
- [13] "Sri lanka's first-ever humanoid robot, diyazen to take up duties at lotus tower — asian truth." [Online]. Available: <http://www.asiantruth.com/sri-lankas-first-ever-humanoid-robot-diyazen-to-take-up-duties-at-lotus-tower/>.

- [14] D. 24, “Story of the first ever high tech humanoid robot in sri lanka : diyasen — full programme,” YouTube, 2023.
- [15] A. C. Gammanpila, A. Wijesinghe, T. Wanniarachchi, V. Amarajeewa, D. Jayasinghe & R. de Silva. (2020). The sorting hat, a mediator social robot with a fictional character appearance for autistic children. *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction, 03 2020*.