

Hybrid Humanoid Robot for Naval ship

Beyond Borders: Nepali Immigrants tangled in the kafala system

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By

Sagar Sapkota

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Technical Team Members: Sagar Sapkota, Yushek Sitoula, Lucas Murphy, Austin Davis,
Orlando Sadek, Karthik Eswarapragada

On my honor as a University student, I have neither given nor received unauthorized aid
on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

ADVISORS

MC Forelle, Department of Engineering and Society

Chloe Dedic, Department of Mechanical & Aerospace Engineering

Introduction:

Numerous immigrants from various South Asian and African nations share similar faith in the Gulf countries. The Gulf Cooperation Council countries (GCC) is comprised of six countries in Arabia: Qatar, Bahrain, Kuwait, Oman, Saudi Arabia, and the United Arab Emirates (Naufal, 2015). However, for my paper, I have concentrated my interest on uncovering challenges particularly faced by Nepali workers from their initial encounters with private recruitment agencies through their employment conditions in Qatar.

In Nepal, for an average city teenager who has recently graduated high school, the path might involve the SAT, TOEFL, or similar exams as a remarkable opportunity to pursue higher education in the Western world. In contrast, 22-year-old men from rural areas may find themselves seeking buyers for their land and cattle as they strive to gather enough funds for a plane ticket to Gulf countries. Although their destinations are thousands of miles apart, their viewpoint is the same; they lack opportunities in Nepal and share a common hope for better life and financial stability. According to UN data from 2022, “of the nearly 2.7 million people living in Qatar, Nepalis account for about 432,000 – or 16% of the total population” (Rai, 2022). The Nepali population in Qatar holds a significant presence and plays a crucial role in the nation's economy. They are heavily involved in physically demanding jobs like construction. Qatar's progress would not be possible without these hardworking immigrants. Yet, the daily experiences of these workers are filled with misery as they are tangled in the kafala system. The kafala system functions as a sponsorship arrangement that allows agencies to recruit migrant workers from other countries, and employers often misuse it to oversee and regulate the activities of these workers.

This STS research portion will focus on the struggle faced by Nepali immigrants in Qatar. I will highlight the recurring incidents of fatalities and the factors behind these occurrences. Furthermore, I will present the typical experience of the average Nepali working in construction sites under the kafala system. On the technical aspect, we are very optimistic regarding our vision for humanoid robots to collaborate with humans, especially in situations involving extensive amounts of strength and undertaking dangerous tasks. Upon success, we would be able to open a gateway for further advancements in the field of robotics. I will be working alongside five other mechanical engineering students in an attempt to develop Hybrid Humanoid Robots (HHR) designed for deployment on naval ships. Our HHR is designed to be implemented in the Naval ship setting, but it is not limited to only Naval environments. They can be applied in various industries and situations to assist humans. Humanoid robots have the potential to greatly assist Nepali immigrants on construction sites in Qatar. In the technical section of the paper, I will provide a detailed description and functionality of this HHR. Also, I will provide a few examples of companies that manufacture various types of humanoid robots and illustrate their practical applications.

Technical Topic: Hybrid Humanoid Robot (HHR)

I am a fourth-year mechanical engineering student at the University of Virginia. I am assigned to a project with 5 other students. Our project focuses on the hybrid humanoid robot. For further discussion, I will be referring to a hybrid humanoid robot as HHR. In general, HHRs are different from typical robots. As the name suggests, these robots possess a combination of human-like physical features and mechanical functionality. These robots are a fusion of both

traditional robots and humanoids; this allows them to perform a wide range of tasks in various environments due to their mobility and unique features. HHR can effortlessly perform repetitive tasks in a few seconds which would otherwise take hours and a tremendous amount of strength for humans to complete. “Robots are tough, fast and very accurate machines which can complete their tasks faster, with better quality and for a lower price than humans”(Vysocky & Novak,2016).

My team and I will be building custom-design and developing a robot that can perform different tasks in navy vessel environments. It should be able to go through watertight doors and climb a 63-deg ladder. Also, it will be biped with feet on complex terrain and also be quadruped with wheels on flat terrain. This phenomenon is pretty complex. We will try to create a bipedal and a quadrupedal structure using self-adjusting pneumatic tires and flexible mechanisms. There have been many humanoid robots capable of mimicking human movements. Two impressive robots that Boston Dynamics have made are Atlast and Spot. Spot is an 84 cm and 25 kg four-legged robot that can map its environment, open doors, and climb stairs (Guizzo, 2019). Atlas is a 150 cm and 80 kg humanoid robot that is powered by a hydraulic system that can perform complex movements (Guizzo, 2019). The primary objective of our project is to enable these robots to carry out various tasks on Navy vessels, similar to tasks performed by humans on a daily basis. Robots, in general, share similar components and parts, with differences lying in the quality and capacity of these components. We will be using robotic operating systems (ROS) to control the movements of these robots.

This project will undergo a series of product design and development phases. This semester we are mostly working on concept development. In this phase, we plan out customer needs, tager specifications, concept generation, concept selection, concept testing, project

planning, and economic analysis in a sequential manner. Next semester we will get to physically work on the HHR and go through the manufacturing processes. Initially, we had many customer needs from the Navy side but were able to narrow it down to only five: compliant wheel/foot mechanism, would like to climb a 63-degree ladder, efficient on both flat and uneven floors, operates through teleoperation, and needs to walk over a watertight door. We were able to refine these customer needs by ranking them in terms of technical difficulty and priority.

The idea of a compliant foot mechanism is quite complicated. This has never been done before and our customer has a strong preference for implementing this in our HHR. “Now, Cog features two six-DOF arms, a seven-DOF head, three torso joints, and much richer sensory systems” (Adams, Breazeal, Brooks & Scassellati, 2000). Although there have been significant improvements in the internal features of humanoid robots, there are currently no robots capable of being both bipedal or quadrupedal. However, our goal is to incorporate both of these features in a single HHR. We plan to integrate an inflating and deflating system, probably made of rubber, for the foot mechanism. In its deflated state, it should just function like a regular bipedal and be able to climb stairs while balancing the center of mass. If it is an inflated state, it should be capable of adjusting its position into a quadrupedal form. We are planning to use a compressor and pressure gauge to regulate the air pressure of this foot mechanism. This allows the HHR to navigate around the ship more effectively because it is able to deflate when it encounters stairs and watertight doors. “In the safety standard, ISO EN 10218 for robots and robotic devices are defined as four basic types of HRC. For some types of cooperation, it is necessary to use special collaborative robots with embedded sensors” (Vysocky & Novak, 2016). Our HHR will utilize Sensors, actuators, microcontrollers, power supply, and other mechanical

components to operate through teleoperation and be able to navigate around the ship autonomously.

We have divided our team into three subgroups: mechatronics, ROS, and mechanical designing. The Mechatronics group is responsible for creating system diagrams and integrating hardware components. The ROS group, which I am part of, will primarily focus on software development using Python and C+. Our objective is to run these codes on the computer to control the microprocessor and execute desired commands. I will be developing a variety of scripts to control actuators. The mechanical group is responsible for designing the 3-D model of the foot mechanism. This team will be going through a series of trials and errors during the designing process. They will also be responsible for testing the strength of the prototype on CAD using finite element analysis (FEA).

This project is undoubtedly complex and challenging, but we hope to gain valuable experience and enjoy every process of product designing of the HHR. When we finish, we aim to create a path for further advancements in the field of robotics. These humanoid robots could be fitted not only in naval environments but also in various other settings, working with and without humans.

STS Topic: What impact do labor recruitment agencies and the kafala system have on the experiences of migrant workers in Qatar?

Nepal remains one of the world's poorest and least-developed countries. Many people do not see the future and promising opportunities in this country so they seek a better path elsewhere. Some apply for the diverse lottery, while others pursue student visas or work visas. The diverse lottery is a program that grants people, a limited number, immigrant visas to come to

the United States due to the low immigration rate. Applying for a work visa for a Gulf country demands careful planning and consideration. The first step is finding the ideal private recruitment agency (Robinson, 2022). Many of these immigrant workers are illiterate, so often these agencies take advantage by overcharging them, altering contracts, providing false information, promising higher pay, and, in a worst-case scenario, simply stealing the money and fleeing. Krishna Magar signed a contract that offered him approximately \$550 per month security guard at the World Cup but did not receive the promised rate (Panja & Sharma, 2022).

Migrant workers, especially across the Gulf states, regularly face labor abuse and exploitation in various forms even in this day and age (HRW, 2020). In Qatar, a group that has disproportionately faced exploitative work conditions are the Nepali migrant workers who have been employed in various sectors to support the nation's efforts in preparation for the FIFA World Cup. Since 2010, there have been over 400,000 Nepali migrant workers who have immigrated to Qatar looking for foreign employment (Panja & Sharma, 2022). Over this period, official reports indicate that over 2,100 workers have passed away, from various means including an alarming number of suicides and unexpected health issues such as premature heart attacks (Panja & Sharma, 2022). While not all of these deaths can be officially attributed to onsite workplace accidents, the practices that go into the employment of these workers, including exploitive measures such as illegal recruitment fees, non-payment of wages, debt bondage, and dangerous working conditions serve as the root cause of the struggles faced by migrant workers. These workers face various forms of abuse, with the impact being both physical and mental. “We workers have shed blood, sweat, and tears to make the World Cup happen, but we weren’t paid properly for it”, said Adhikari (Pattiss & Acharya, 2022). A large portion of this workforce has seen early onset health issues which can directly be linked back to their working conditions, with

many workers returning home with no compensation from either FIFA or Qatar as they face continued poverty and debt.

These workers do not get paid for months and are trapped in the kafala system. The kafala system completely makes workers rely on their employers for everything. It restricts workers' freedom and allows employers to have complete control over these immigrant workers (Robinson, 2022). Employers also hold these worker's phones, visas, passports, or any sort of important document so they can not leave the country and are forced to stay working. No matter how you look at it, this is modern-day slavery (Ratcliffe, 2018). Nepali has been the victim of this “politics” for decades. In Winner’s paper, he uses the word "politics" to describe how power and authority are organized in human groups and everything that happens within those power structures (Winner, 1980, p.123). These agencies take advantage of their power over migrant workers by coercing them to work additional hours without providing adequate compensation. The migrant workers poured their blood, sweat, and tears into constructing the stadiums for Qatar to host the FIFA World Cup; yet the Qatari elite who contributed nothing to the physical construction of these infrastructures proudly took credit for the completion of the event.

The system also affects the remittance that these workers send back home. Remittance is the source of living for many in Nepal. Nepal is currently the fifth most remittance-dependent economy in the world (Rai, 2022). The mistreatment and exploitation of Nepali migrant laborers require immediate focus and thorough reforms to protect immigrant workers' rights and welfare. My research will utilize online articles, news reports, and academic journals as sources to gather information. Importantly, I will interview my relative who contributed to the direct construction of two of the FIFA stadiums that were constructed.

Conclusion:

In conclusion, the progress achieved in Qatar's infrastructure would not have been possible without the hard work of Nepali immigrant workers. These Nepali workers leave Nepal with the hopes of improving their lives and financial stability but often end up falling victim to the kafala system imposed upon them. Their lives become exceedingly challenging under this system and become entangled in a complex mess that is very difficult to break from. My technical project ties very closely with this STS research topic because humanoid robots are designed to make human lives easier under any circumstances. Humanoids in the modern world are used in various dangerous tasks and prove to be very effective. This research underscores the significance of addressing the ongoing challenges faced by Nepali immigrants and highlights the potential for robotics to improve working conditions across a wide range of industries and environments. No family should have to receive news about the death of their loved ones in their Village.

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