

Mobile Robot Platform for Monitoring COVID-19 Non-critical Patients

The ongoing COVID 19 pandemic is causing an exponential growth in the number of globally infected patients with Sri Lanka being no exception. About 80% of the COVID - 19 patients are not in critical state. Monitoring each patient closely and carefully and providing care to the infected patients is essential for the proper management of the disease. Each COVID 19 patient needs to be monitored on average 3 times per day. Each visit takes on average 15 - 20 minutes. This drastically increases the risk of healthcare providers being exposed to the disease in spite of the protective gear they wear. The official data accounting for the number of health care workers who have been exposed or infected so far around the world is increasing. Thus, a solution is urgently sought to reduce the direct contact between a COVID 19 non-severe patients and healthcare providers especially in the event where the outbreak can reach proportions where it requires the concurrent treatment of about 10-20 patients in one medical ward. In response to this requirement we have developed a robotic platform that can be used to perform the monitoring and medication providing functions for patients and thereby reduce the direct contact between healthcare providers and the patients.

The robot design, development and assembly was carried out by QRBOTS using the technologies that it had been developing over the past five years. The equipment cost of LKR 485,000.00 was fully funded by the New Zealand Chapter of the Alumni Association of the Faculty of Engineering of the University Peradeniya. The robot will be donated for the use at the COVID-19 ward of the Kandy National Hospital Sri Lanka as a joint effort by the New Zealand Chapter of the Alumni Association of the Faculty of Engineering of the University Peradeniy and QRBOTS (a joint venture of CodeGen Int. Pvt. Ltd. and the Dept. of Mechanical Engineering University of Peradeniya).

QRBOTS is an unmanned vehicle navigation and controls solution provider that is based at the CodeGen International (Pvt.) Ltd. funded QBITS lab at the Dept. of Mechanical Engineering, University of Peradeniya. The venture was initiated by CodeGen International (Pvt.) and University of Peradeniya in 2012. The mission of QRBOTS is to provide advanced robotics and automation-based solutions at a regional and global scale. QRBOTS specializes in the development of intelligent unmanned air, ground, and underwater vehicle navigation platforms. We also aim at promoting the establishment and fostering of intelligent robotics-based technology across Sri Lanka. Further information about the technologies developed by QRBOTS can be found at <http://qrbots.lk/> All algorithms and associated software was developed at the University of Peradeniya over the past six years. Over these six years CodeGen has fully funded all equipment and had employed over 20 fresh graduates as Research Assistants/R&D Engineers. Over the course of these activities CodeGen has also sponsored the equipment for over 15 undergraduate projects and provided industrial training opportunities for about 8 undergraduate students of the Faculty of Engineering at University of Peradeniya.

The Specifications of the Proposed Robot

The proposed semi-autonomous mobile robot platform will be equipped with two-way audio-visual communication, basic food and essential item delivery, and waste transport facilities. Specifically, it will have the following functionalities:

1. The robot will be equipped with a vision-based obstacle avoidance system to ensure safety.
2. The robot can be easily navigated using a keyboard/hand held device/laptop remotely through the internet. In the future it will also be equipped with face recognition of patients and vision based autonomous navigation in a known environment.
3. Doctors or healthcare providers can communicate and monitor the patient remotely via the robot. A camera and a visual monitor will be available for both the healthcare provider and the patient facilitating a live audio / video conversation between the two. The robot-mounted camera can be remotely targeted at the healthcare providers discretion.
4. With the camera and display system of the whole setup, patients can receive visual commands and instruction from the health care provider. This visual interaction between patient and the health care provider can improve the patient's confidence.
5. The robot will be designed so that it can perform the majority of monitoring facilities at a distance of 3 feet away from the patient in order to reduce the contamination of the robot. It is also designed so that it can reach very close to the patient if necessary.
6. Can separately provide patient essential requirements such as food, linen sanitary items etc.
7. Can separately remove waste items from each patient.
8. Sterilization method is required for the robot before it enters the base station where the healthcare providers are located
Because the robot is resistant to water and dust, it can be sterilized by alcohol and UV.
9. The robot structure is made using stainless steel and all the critical parts will be covered with acrylic covers to improve the durability.
10. The Power supply unit
The robot is battery powered and can be operated for 5 hours at a stretch on a

single charge cycle. Robot can be directly plugged to the 230V AC supply to recharge.

11. Technologies used in this robot (Wi-Fi etc.) are safe and will not cause any harm to humans.
12. Number of patients covered per hour
The robot has a sufficient speed to travel fast and the robot operator can control the speed according to the necessity.

Summary Specifications

1. Dimensions : - 0.575 x 0.56 x 1.53 m
2. Weight : - 55kg
3. Maximum carrying weight : - 50 kg
4. Remotely operating max. distance
(with a single WiFi router) : - 30m
5. Navigation method : Through a Computer Keyboard/Android Device
6. Safety features : Vision base Obstacle Avoidance
7. Battery charging : - 230V (AC)
8. Battery Life : - 5h from single charge cycle
9. Remote monitoring and Live Audio/Video transmission conversation between doctor and the patient
10. The robot can be sterilized

The Completed Robot

The following video demonstrates the initial testing of the completed product.

<https://youtu.be/TL48Mga2tFY>





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