

# A Development of Adjustable Standing and Automatic Stop Electric Wheelchair Prototype Operated with A Smartphone

Nutdanai Singkhleewon<sup>a</sup>, Teeravit Asawasilapakul<sup>b</sup>

<sup>a,b</sup>Electronics Computer Technology Program, Faculty of Science and Technology, Bansomdejchaopraya Rajabhat University, Bangkok  
Corresponding author e-mail: mar6666@hotmail.com

## Abstract

The objective of this research is to develop a smart adjustable standing-sitting wheelchair prototype that can be operated with a smartphone. Its distinctive feature is the ability of standing-sitting adjustment and automatic stop when approaching obstacles. This device can be controlled from installed joysticks and Android smartphone control program. Arduino microcontroller is the main processing unit to control drive system operating. A Linear actuator is used for standing-sitting adjustment. An ultrasonic sensor is used to make the smart wheelchair stop automatically when detect obstacles. A wheelchair tested showed that it can move at a speed of approximately 3 kilometers per hour, take 14.30 seconds for standing upright adjustment, release down 13.56 seconds, and average automatic stopping distance is 43 centimeters.

**Keywords:** Electric wheelchair / Adjustable standing electric wheelchair /Automatic stop system / Smart wheelchair.

**Correspondence:** Nutdanai Singkhleewon  
Electronics Computer Technology Program, Faculty of Science and Technology, Bansomdejchaopraya Rajabhat University, Bangkok

**Corresponding author:** mar6666@hotmail.com

## INTRODUCTION

The United Nations expects that between the years 2001 – 2100, most of the countries are being the aging society. The growth in aging population occurs in almost every parts of the world differently depend on economic, social and environment. In 2018, the number of senior populations aged 80 years or older in Thailand was 1.32 million people of overall population of Thailand 69.2 million. Most of them have health problems especially problems of walking, standing and sitting [1]. Moreover, it was discovered that there were 2,027,500 registered disability persons, which was accounted to 3.05 percent of total population. Of which 1,002,083 people have problems of mobility or physical disabilities (49.42 percent of the total disabilities). For these reasons, both the elderly and the disabilities need to live in bed or rely on mobility aids like wheelchairs [2]. However, prolonged sitting in a wheelchair can lead to health problems, namely reduced bone density, stiffness joints, muscle contraction and problems with the circulatory system and pressure sores[3] - [6] This includes patients with spinal cord injuries who require supervision, rehabilitation and mobility aids that enhance more freedom in mobility [7]. From many researches and development, an adjustable standing electric wheelchair is highly necessary to reduce the negative effects of prolonged sitting in a wheelchair [3]

- [6]. Also including, patients with spinal cord injuries who need care and rehabilitation, for example, bone mass treatment, increasing blood flow throughout the body, and reducing pressure sores and bone disorders, preventing the occurrence of muscle spasms [7] that help rehabilitation of patients with spinal cord injuries. From psychological point of view; adjustable standing wheelchairs have increased the user's confidence higher than that of standard wheelchairs [9]. Because they can help patients do activities in standing positions conveniently such as communicating with staff on counter, withdrawing cash from an ATM and supporting elderly getting up from sitting in wheelchairs comfortably. Furthermore, the research team has an idea to develop the adjustable standing electric wheelchair for medical benefits, and enhance rehabilitation of the patient and elderly. Researchers also developed the wheelchair automatic stop systems to increase user safety, including control with smartphone functions.

## MATERIALS AND METHODS

This research is continuously developed a standard wheelchair functions of adjustable standing and automatic stop when approaching obstacles. Overview of working design is shown in figure 1. When start-stop switch is turned on, moving function has not yet operated until the