Chapter in Book

Remote Control Wheelchair with Falling Detection System

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Abstract: *A Smart Wheelchair is a Power Wheelchair outfitted with several sensors, assistive technologies, and computers. This allows a person with a disability, such as an impairment, or permanent damage, to move freely and safely. These wheelchairs are gradually replacing ordinary wheelchairs; however, expensive pricing prevents many disabled individuals from purchasing them. According to the WHO, only 5-15 percent of the world's 70 million disabled persons have access to wheelchairs. Thus, wide research has been done in recent years to help disabled people to own wheelchairs. With the advancement of technology, the design of wheelchairs also evolves from manual handling to the one with artificial intelligence. Some of the designs imply Internet-of-things to operate the wheelchair. In this project, a prototype of a smart wheelchair with a falling detection system has been developed. This special feature is added to notify the caretaker if something happened to the person under their care. The system develops by using Arduino UNO, Bluetooth module, and the notification system using the IFTTT platform.*

Keywords: wheelchair; Bluetooth; falling detection; IFTTT.

1. INTRODUCTION

According to World Health Organization (WHO), 70 million disabled people need a wheelchair in walking or moving around but only 5 to 15% have access to it (WHO, 2022). This is because of the limitation of knowledge and skills among health personnel in providing a wheelchair to meet the person's specific needs. To move a wheelchair, the person must use a lot of energy for manual movement. A typical wheelchair weighs between 30 kg and more than 30 kg (Winter, n.d) When a patient sits on it, it grows to be twice as big. So, disabled people and patients will find it hard to move a wheelchair with a load.

2. METHOD & MATERIAL

This project aims to produce a prototype of a smart wheelchair and assist people or patients in going anywhere effortlessly. This will make it easier for people to push the wheelchair, which will lessen the strain people feel while pushing the wheelchair. Then it can also improve an older person's balance and posture stability. Therefore, to achieve this system requirement, this prototype of the smart wheelchair was developed using main components such as an Arduino Uno board, Bluetooth module, and IFTTT software as depicted in Figure 1. Figure 2 shows the flow chart of Bluetooth control for the movement of the wheelchair. Four directions have been set for the prototype of this smart wheelchair; Forward, Turn Left, Turn Right, and Backward. Figure 3 shows the falling system detection system flowchart. In this system, sensors are attached either to the wheelchair or to the patient. When the system is triggered (patient fell/ wheelchair fell) a notification will be sent to the caretaker or any registered person.

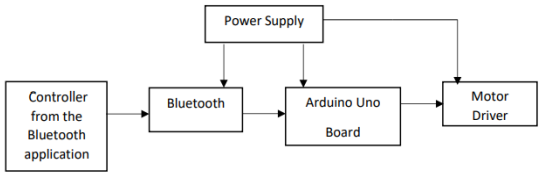


Figure 1. Block Diagram of the system development

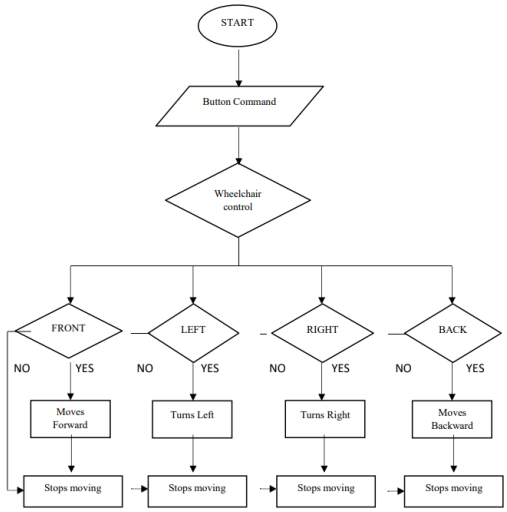


Figure 2. Flowchart of the Bluetooth Control

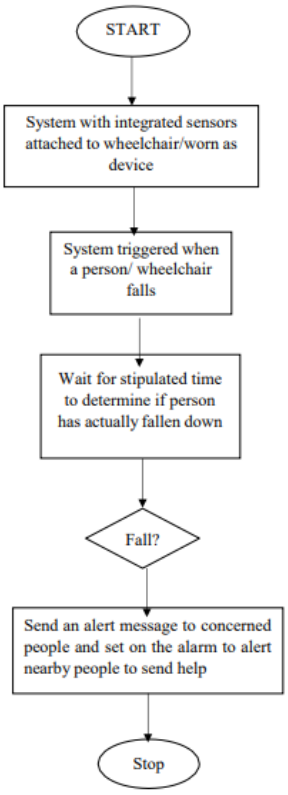


Figure 3. Flowchart of the falling Detection system

3. FINDINGS AND DISCUSSION

The prototype of the Smart Wheelchair with Falling Detection was developed by using Arduino UNO, Bluetooth module, nodeMCU, motion sensor, and the notification system using the IFTTT platform. Figure 4 and Figure 5 show the connection of the system developed in this project. Motion sensor, MPU 6050 is used as the detector in this project where it uses the I2C-bus to interface with the Arduino.

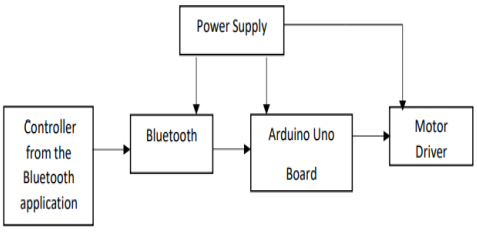


Figure 4. Block of the smart wheelchair system

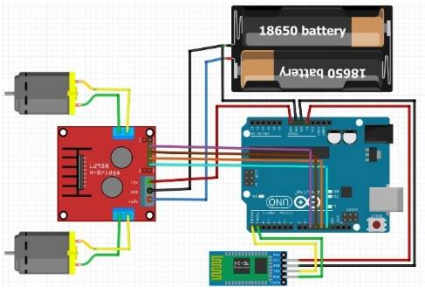


Figure 5. Connection for the Arduino UNO, motor driver, Bluetooth module, and battery.

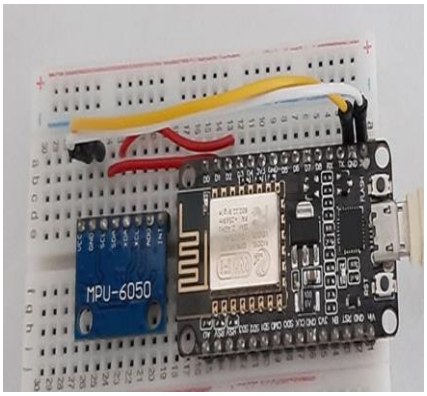


Figure 6. NodeMCU ESP8266 and motion sensor.

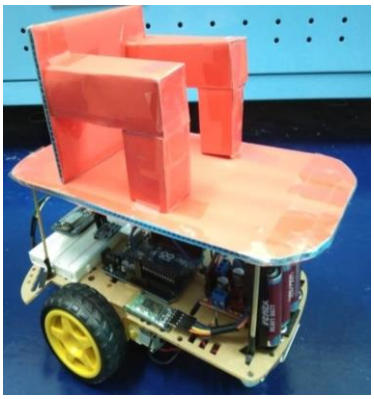
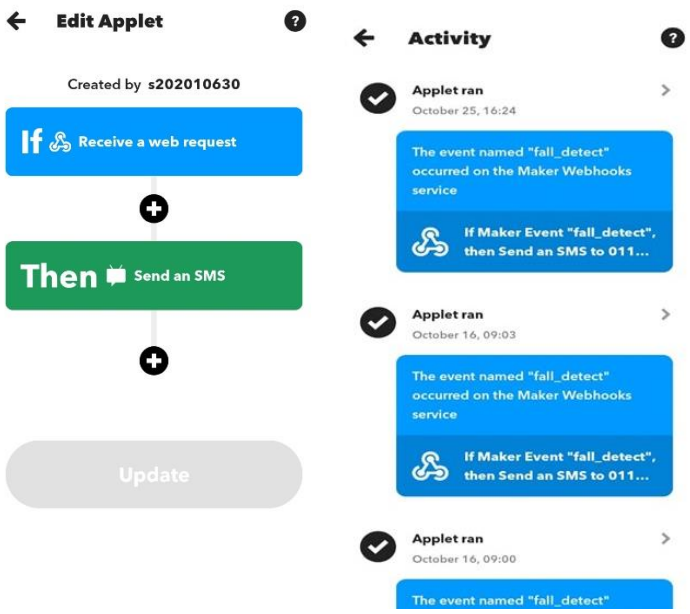


Figure 7. The prototype of the smart wheelchair falling detection system.

IFTTT or 'if this then that is a software platform that provides the connection with apps, devices, and services. IFTTT then triggers the automation involving those apps, devices, and services using applets. This applet can be turned On or Off using IFTTT's website or mobile apps. In Figure 8 (a) and (b), the applets show that the fall happened, and an SMS will be sent to the caretaker or registered contact number.



(a) **(b)**

Figure 8 (a) (b). Applets

4. CONCLUSION

The main goal of the development of this prototype is to help everyone who needs a wheelchair to get around. This project came up with an Android system that can control the movement of a wheelchair complete with a falling detection system. The goal is to create a movement mode that allows older people with severe limitations to move their wheelchairs on their own. Furthermore, the development of this product is to enable the aged and individuals with physical impairments to control the movements of their wheelchairs using their Android smartphones. The goals were met because the software and hardware implementation went as planned. This system will make it easier for older people and people with physical disabilities to control their wheelchairs. This success will help a lot of people with disabilities. From the research, a wheelchair that can be controlled by a phone will face a successful future. It deserves to be kept and enhanced in the upcoming because it holds a good chance to make things operate more smoothly and safely.

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