UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Development of IoT Wheelchair for Rehabilitation

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree in Electronic Engineering Technology (Telecommunication) (Hons.)

By

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DECLARATION

I hereby, declared this report entitled “Development of IoT Wheelchair for Rehabilitation” is the results of my own research except as cited in references.

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Date	:	27th December’ 2017

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

……

(Project Supervisor)

En. Ahmad Fauzan Bin Kadmin

ABSTRACT

The needs of many people with disabilities can be overcome with powered wheelchair, but some portion of this community is finding it difficult to operate powered wheelchair. This project is related to an android phone-controlled wheelchair along with three types of controller which is Joystick control, D-pad control and Voice control through Bluetooth then navigate its according to command. It is also equipped with obstacle(ultrasonic) avoidance notify, where the person may not be able to avoid in the right time. Depending on the direction received through Android application, IOIO microcontroller controls the motor that will moved the wheelchair's direction either FRONT, BACKWARD, LEFT and RIGHT. The main objective of this project is to felicitate and increase the movement of people who are handicapped and the ones who are not able to move freely with the implementation of IoT platform where this platform could provide data visualization and able to analyze the wheelchair maintenance management and movement. Therefore, this project is coming up with a design of wheelchair which will be an asset for medical department and to make it more advance, this project also will be equipped with IoT concept technology. The Internet of Things (IoT) makes smart objects the ultimate building blocks in the development of cyber-physical smart pervasive frameworks. The IoT has a variety of application domains, including health care. This project surveys advances in IoT-based health care technologies and reviews the state-of-the-art network architecture/platforms, application, and industrial trends in IoT-based health care solution. In additional, this project analyzes distinct IoT monitoring system features, including battery level remaining and temperature control.

DEDICATION

To my beloved parents, the sacrifices you give will not be forgotten. As a human being knowledgeable of service and goodness you cannot reply to me. It is also dedicated to my friends and supervisor of Universiti Teknikal Malaysia Melaka who involved directly or indirectly in assisting me during the course of this final year project and finishing this project report.

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INTRODUCTION

1.0 Introduction

This chapter will briefly explain overall overview of the project scope. This chapter also elaborates the project background, problem statement, the objective of the project and the scope of the project.

1.1 Project Background

Nowadays, the Internet of Things has various applications in human services, from remote monitoring to smart sensors and medical device integration. It can possibly keep patients safe and healthy, as well as to enhance how doctors convey mind too. The Internet of Things (IoT) is a biological community of associated physical objects that are open through the web. The 'thing' in IoT could be a man with a heart screen or a vehicle with worked in-sensors, i.e. objects that have been allocated an IP address and can gather and exchange information over a system without manual help or intercession.

After all, why does IoT need to implement in human daily life? An article by Ashton published in the RFID Journal in 1999 said, “If we had computers that knew everything there was to know about things - using data they gathered without any help from us - we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best. We need to empower computers with their own means of gathering information, so they can see, hear and smell the world

for themselves, in all its random glory." This is exactly what IoT platforms does improves for us. It empowers devices/objects to observe, recognize and comprehend a situation or the surroundings without being dependent on human help.

Back to the title of this project, Smart Wheelchair with IoT was invented in terms of providing a new way to control and monitor all the Smart Wheelchair activities and in the same time, this IoT concepts able user to maintain its operation which is in this project will be covered on the battery indicator, control movement and obstacle detection.

1.2 Problem Statement

Nowadays, the number of elderly people has increased. Some live with their children, some live in adult foster home and some even live by themselves. The problem arises when the elderly people lose their abilities to move around. Not everyone can be in the location to help them all the time. Patients involved in physical injuries and disability are struggling to get through places using the conventional hand wheelchair. A wheelchair designed to be a replacement for walking. It is used for mobility by people for whom walking is difficult or impossible, due to illness or disability. To face this problem, an automatic wheelchair controlled by DC motor will be develop together with IoT concepts implement on it for monitoring purpose.

1.3 Objective

In determining the purpose of the direction of this project, there are several objectives that need to be accomplished in developing of the IoT Smart Wheelchair. This project aims to achieve the following objective:

1. To develop an IoT electrical powered wheelchair that provides data visualization.
2. To analyze wheelchair maintenance management and movement.

1.4 Scope of The Project

The scope of this project is to study the basic of Arduino UNO @ C++ language from several published websites as well as to study the language and code used to control the input signal and transfer the data towards cloud database. The concept of this project is it will possess an input which is control movement, obstacle detection and battery remaining indicator and receive by microcontroller in this project used Arduino UNO R3 as it microcontroller, then the signal receiver will be transfer towards cloud database so that IoT platform used able to display the desire data. For IoT platform used are Thingspeak application where it act as data visualization platform. This project mainly focuses on how to apply the IoT platform onto Arduino UNO R3 microcontroller.

1.5 Project Methodology

In order to produce a good project, there are few strategies that must be taken after. At first, data accumulate about the wheelchair issue must be recognized. Then, more information about the wheelchair problem is gathered from the journals, internet, books, and also articles. Other than that, the research continues with the search on the basic concept of Arduino UNO application and also learnt on command used for C++ to be programmed in the Arduino. Next, after research have been done, the coding will be simulated without any error. After that, the hardware for the Smart Wheelchair will be designed. Lastly, the hardware will be combined with the coding. Once the coding has associated with hardware expected outcome, the data @ signal then being uploaded into database which is provided in a cloud database. In database, the information receive will be process later to provide the right data display. So, from here where all the desired data will be analyse.

1.6 Thesis Structure

Chapter 1:

Chapter 1 will be introduced brief idea of the project. It focused on the overview of the project, detailing the objectives, the problem statement, scope and the outcome of the project.

Chapter 2:

Chapter 2 discussed about the project background. The method concept, theory, and some characteristics of component of the hardware that are used in this project also described. This chapter had been done by doing a research of the previous project.

Chapter 3:

Chapter 3 describes the methodology used in this project. The schedule or steps that need to be completed and detailed reports of studies that were done in order to achieve the aim of the project are presented.

Chapter 4:

Chapter 4 presents the result and discussion. All the simulation, data collection and analysis obtained will be discussed in detail. The result will be compared with the objectives outlined in order to arrive to some hypothesis and conclusion.

Chapter 5:

Chapter 5 states the conclusion and future work that can be undertaken. Some recommendation and suggestion on how to improve the performance of the system based on the desired results will be given.

CHAPTER 2

LITERATURE REVIEW

2.0 Chapter Overview

This chapter provides an overview of previous research on the development of the wheelchair control as well as electronic system. The history of the revolution of wheelchairs appeared in the 1950s where the aim of this invention is to help the disabled people who are face the difficulty in walking. Today's models are better described as electronic wheelchair rather than electrical wheelchair where electronic wheelchair allows for a control of speed, an obstacle detection, voice control, seat tension comforter and many more. Since this application has been widen in used towards wheelchair, the invention keeps growth to be implement with IoT (Internet of Things) concept.

2.1 Revolution of Wheelchair

The principal wheelchairs were self-controlled, and worked by a patient turning the wheels of their seat physically. Obviously, if a patient was not able do this, someone else would need to drive the wheelchair from behind. A mechanized or power wheelchair is one of a little engine drives the wheels to spin. The primary electric-fueled wheelchair was developed by Canadian designer, George Klein and his group of specialists while working for the National Research Council of Canada in a program to help the harmed veterans returning after World War II.

2.2 Previous Development of Wheelchair Technology

A wheelchair assists people to become more mobile and independent. There are many different types of wheelchairs that are used for various reasons. A manual wheelchair is one that is propelled by the user meanwhile Electronic wheelchairs are propelled by a motor and battery.

2.2.1 Previous Studies: Voice Controlled Intelligent Wheelchair using Raspberry Pi

(Akif Naeem and Abdul Qadar, 2016) said, the introduced work is more creative in the sense, it utilizes discourse acknowledgment framework to give guidance development control of the wheelchair. In this wheelchair, no different discourse acknowledgment circuit is utilized on the grounds that it is finished by Raspberry Pi utilizing Speech acknowledgment calculations. The ultrasonic Sonar senor is utilized to identify deterrent inside scope of 6.45 meters. This will offer crisis breaks for assurance to the patient. Discourse Synthesis (Text to Speech TTS) is utilized to give vocal alert to client e.g. "Deterrent identified 7.5 ft. ahead". Google voice seek is additionally accessible to get any sort of data by only a solitary voice charge.

The square graph appeared in Figure 2.1 incorporates every one of the parts of wheelchair. Mouthpiece is utilized to changes over voice orders from sound wave to electrical flag Raspberry Pi is next unit which utilize google API/CMU Sphnix (Speech to Text) for discourse acknowledgment Google API (Speech to Text) changes over this voice summon to content.

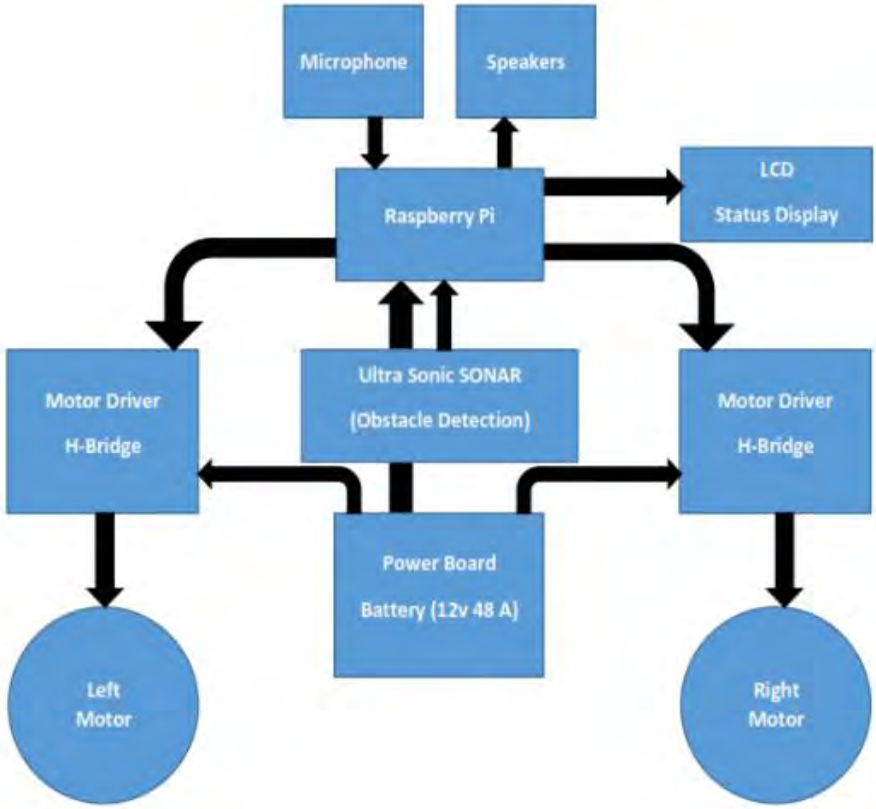

Figure 2.1: Block Diagram of Wheelchair

Presently on inclinations of this content charge Raspberry Pi choose what client needs to do e.g. "Advance/Move Back/Move Left/Move Right or Stop". If there should be an occurrence of any order from clients aside from "stop", Raspberry dependably check separate utilizing SONAR. On the off chance that SONAR has clear separation more than 2ft. Raspberry Pi is utilized as controller and can be customized in C#, Python, PHP, Java, Go, Pascal and Scratch and so on. Power Board has 12v48A battery to give voltage.

2.2.2 Previous Studies: Smart Electronic Wheelchair Using Arduino and Bluetooth Module

Deepak Kumar Lodhi (2016) describes the motorized wheelchair by using voice-controlled wheelchair using embedded system. The system has two parts, namely; hardware and software. The hardware architecture consists of an embedded system that is based on Arduino Uno board, a Bluetooth Module, Motor Driver and an Android phone. The Bluetooth Module provides the communication media between the user through the android phone and the system by means of voice command given to the android phone. The user speaks the desired command to the "BT Voice Control for Arduino voice (AMR Voice Application)" software application installed in the android phone that is connected through Bluetooth with Bluetooth Module SR-04. The voice command is converted to an array of string and the string is passed to Arduino Uno connected to it. Once the Bluetooth Module receives the message, the command sent will be extracted and executed by the microcontroller attached to it and depending on the commands fed to the Motor Driver, the motors will function accordingly. The system will interpret the commands and control the Wheelchair accordingly via android application. Meanwhile, the ultrasonic sensor works while the circuit is on and makes sure the path has no obstacle and if any obstacle occurs it notifies the Arduino and stops wheelchair till further command is obtained from the user.

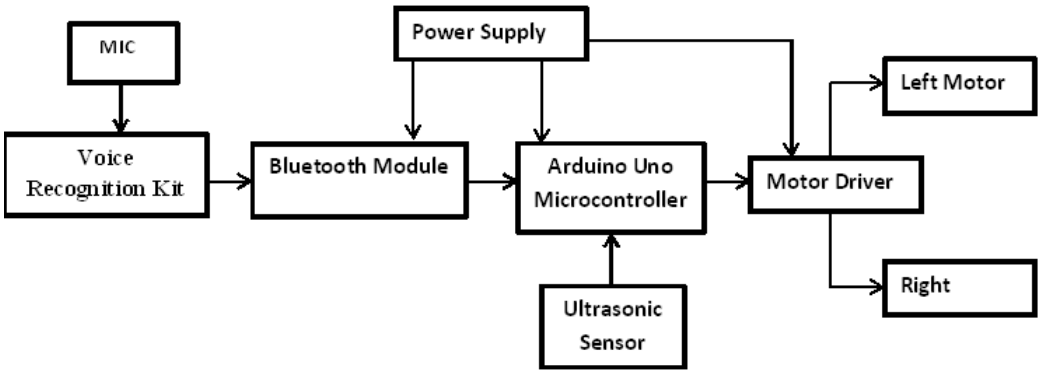

Figure 2.2: Block Diagram of Smart Electronic Wheelchair

2.2.3 Previous Studies: Development of Smart Wheelchair System for a User with Severe Motor Impairment

Mohd Razali, Kobayashi, and Kuno (2012) implemented an electric wheelchair (TT-Joy, Matsunaga Corp.). It is outfitted with a switch and four kinds of sensors as appeared in Figure beneath: a standard webcam (Logicool), a RGBD Camera (Kinect, Microsoft), a laser go discoverer (UTM-04LX, Hokuyo Electric Machinery), and an Inertial Measurement Unit sensor (VN-100, Vectornav).

As illustrated in Figure 2.3, the principal HCI input gadget is the switch. It is a solitary and passing compose in nature that is in charge of setting off a few moving modes (i.e., "stop", "self-loader" and "manual") contingent upon to what extent the client gives it "on." It a chance to can be acknowledged by different mediums, for example, distinguishing movement of facial parts (e.g. eye squinting or shaking), voice or a catch switch. Physiological highlights will force much weight to the client when she/he needs to issue an order oftentimes, particularly when she/he explores in a restricted space. Subsequently, they utilize a basic nibble like switch catch (i.e., not a genuine chomp switch but rather the one that we created impersonating the idea of the switch operation). The second HCI input gadget is the webcam that is used to direct the wheelchair in the manual mode. It additionally gives the general heading to move when looking with snags in the semi-self-governing mode.

Figure 2.3: Sensor Arrangement

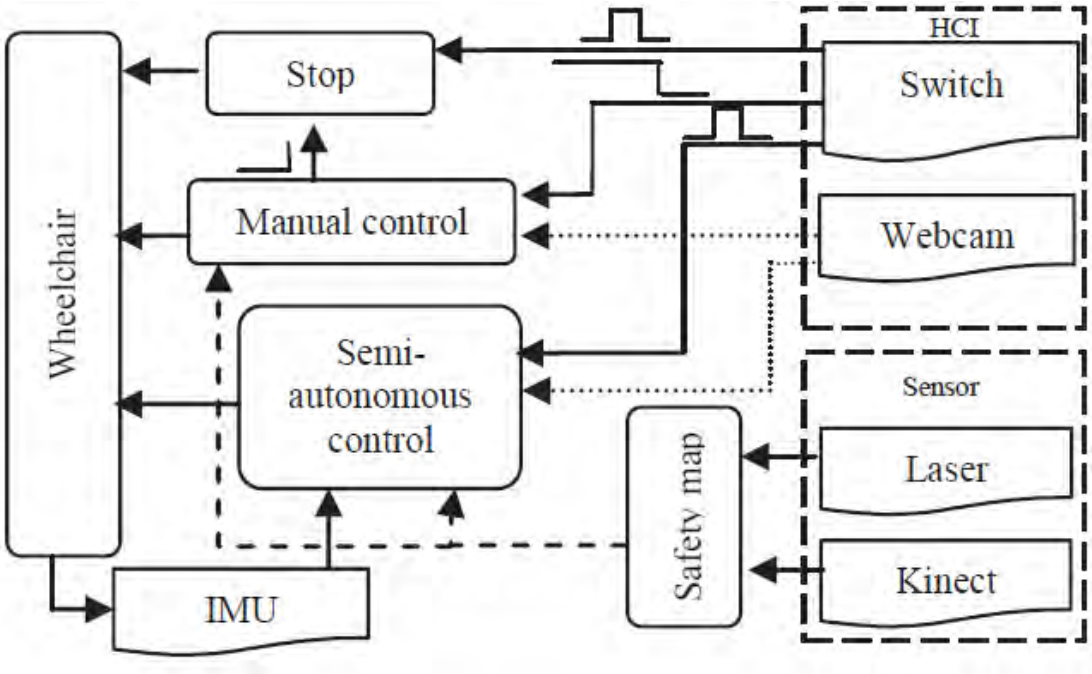

Figure 2.4: The Operation Flow for Smart Wheelchair System

For the sensor part, the blend of the laser and Kinect is utilized for distinguishing deterrents and debilitating zones in the wheelchair's region. Before utilizing the two sensors, an adjustment is performed to guarantee the unwavering quality of the acquired information. They utilized the standard stereo alignment method for the Kinect, and the direct adjustment demonstrate for fitting information from the Kinect and the laser. The IMU sensor gives the data about the wheelchair's present state on the planet organize and is for the most part utilized here for remedying the heading introduction. Yield from this sensor is aligned, and the blunders are remunerated by utilizing Extended Kalman channel. In this manner, the yield gives solid 6 perusing.

Essentially, amid full time operation, they don't specifically utilize the HCI contributions to constantly control the wheelchair; rather they just utilize it for heading the wheelchair into the client's expected course through the manual mode. In the framework, the PC through semi-self-ruling controller assumes control over the duties regarding route and low level control, while the client deals with just deciding the general headings of movement. This outcomes in low client inclusion and higher client comfort. Amid moving, if the client needs to prevent or veer off from the arranged way, she/he can simply