Multidisciplinary Applied Research and Innovation Vol. 2 No. 3 (2021) 060-063

MARI

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/mari
e-ISSN :2773-4773

Dynamic Motion Luggage

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DOI: https://doi.org/10.30880/mari.2021.02.03.011
Received 05 September 2021; Accepted 05 October 2021; Available online 15 December 2021

Abstract : The Dynamic Motion Luggage was designed to enhance the travel experience of travellers around the world through the integration of an auto-follow system. The Dynamic Motion Luggage was constructed as a fully automated device that can also be used as a traditional luggage. It aims to eliminate the need to haul luggage during travels and enable users to free up their hands thus giving them more freedom and reduces strains on the wrist. The product is developed based on an auto-follow system using hardware and software circuit built in the luggage. The auto-follow system in the luggage connects with its user`s smartphone using Wi-Fi and it follows the movement of the phone.

Keywords: Travel Experience, Auto-Follow System

1. Introduction

Dynamic Motion Luggage (DML) is developed to resolve the problems faced by travellers. Modern travelers come across many problem during their travels. People travelling over long distance are affected whereby the luggage put strain on their arms and wrist, especially if their luggage is heavy. Bearing the luggage occupies the hands; inevitably restricting the usage and availability of the hands when on the move. In addition, almost everyone owns a smart device that requires charging. Travellers often feel stressed that their device will be battery depleted before they could get to recharge. Dynamic can be defined as a process characterized by constant progress while motion is referred to the process of moving or being moved. The features of this luggage includes an auto-follow system and an electronics charging unit. The auto-follow system consists of several components connected together and placed in the luggage; and an application on a smartphone to work (refer **Figure 1**).

The luggage follows its owner by connecting to the owner's smartphone via WiFi through a ESP8266 module which acts as transceiver on the luggage. The distance and orientation information is retrieved and calculated using Wi-Fi modules and GPS modules. An Arduino Mega acts as the microprocessor. The system`s input is in the form of a GPS module and Compass Module. The output is from the DC motor powered wheel using a motor driver. All this component are integrated and placed in a wooden box in the luggage. Coding is done and uploaded to the Arduino Mega which allow the user to power on the system in the luggage and connect it to their smartphone using an application called

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Blynk. The luggage works by calculating the distance between the smartphone and luggage and it moves towards the coordinates of the smartphone autonomously. The luggage can carry a load of 6kg.

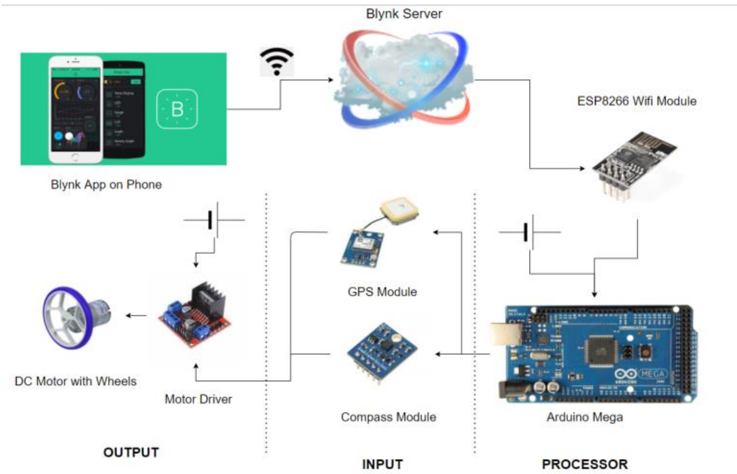

Figure 1. How the components work together

2. Materials and Methods

2.1 Components

The setup involves using main components such as Arduino Mega & Type B Cable, 12V DC Motors, 3s Lipo battery 25C 2500mAh, portable USB charger,L298N motor driver, breadboard, HMC5883L Compass module, ESP8266 Wi-fi module, GPS module (Neo 6M uBlox), jumper wires, resistors [1k(2pcs) and 2k(1pc) rated], Bylnk Iot application, hard case luggage and Arduino IDE software for programming) (refer **Figure 2**).

2.2 Setup

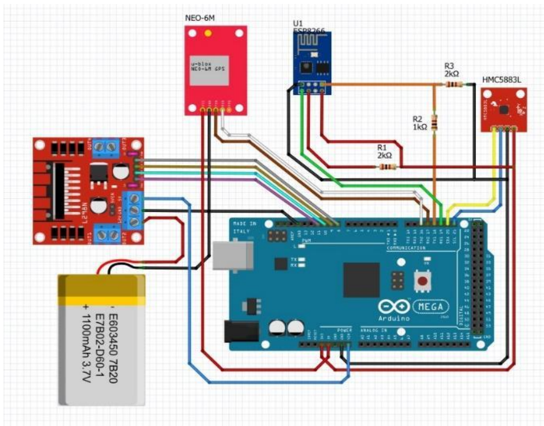

Figure 2. Schematic Diagram for the Auto-follow system connection

A hard case luggage with swivel wheels will be used. The size of the luggage will be a standard hand carry. The auto-follow mechanism works by connecting to a smartphone using Wifi and following the movement of the phone using its GPS coordinates. This is done through a downloaded application called Blynk. Once opening the Blynk app, one has to connect the luggage by enabling the mobile hotspot feature on the smartphone. The app`s interface will have a button to turn on or the off the auto-follow mode, a widget that shows GPS coordinates, and a button to connect the phone to the luggage system. Once connected, the app will gather the phone`s location and coordinates through the phones GPS system. This information is transmitted to the system in the luggage using the Wifi module. The GPS module in the luggage also generates its owns coordinates information for the luggage. The microprocessor, Arduino Mega, will compare both the coordinate and compute the distance between them. The compass module will then determine the heading direction as in North, South, East, West, Northwest, Northeast and etcetera for the luggage to travel to reach the phone. This is essentially planning the route to follow.

The luggage has a DC motor and a motor driver (refer **Figure 3-5**). This drives the luggage wheels allows it to move autonomously. The luggage moves at a rate of 75RPM. Once the route has been determined, the microprocessor will trigger the motor driver to drive the DC motor with wheels towards the phone. This is how the auto-follow mechanism works in theory. For all this to work, programming must be done. Programming will be done to the Blynk app and the luggage system by uploading coding into it using Arduino IDE programmer (refer **Figure 6**). The system in the luggage uses two (2) separate power source. A portable USB charger to power up the Arduino Mega, GPS module, compass module and Wifi module. It can last for 48 hours of continuous usage before needing a recharge. The Lipo battery is used to power the DC motor and motor driver board. This battery can last for around 2.5 hours of continuous usage before needing a recharge. The luggage consists of four (4) wheels. Two (2) front wheels, fixed and attached to the DC motor, allowing only forward and reverse movement; and two (2) back wheels, swivel wheels that can rotate 360 degrees. All of the system`s component will be placed in a wooden compartment at the base of the front half of the luggage case. The limitation of this project is that it does not have an advance obstacle avoidance system. The luggage follows the owner`s path therefore it is important for the user to use a clear and open space when walking.

3. Results and Discussion

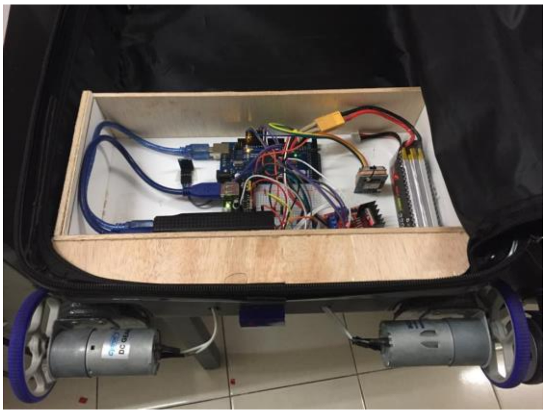

Figure 3. The components assembled in the luggage

Figure 4. View of the system inside

Figure 5. Full view of the complete luggage

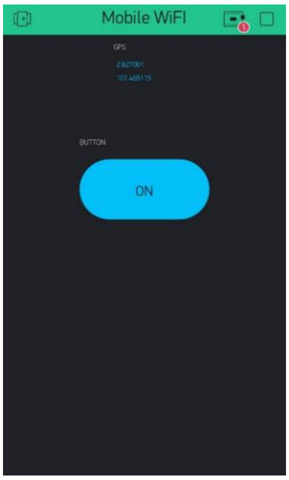

Figure 6. The interface of the Blynk App

The luggage does work as intended. However, one of the limitations of this product is that sometimes it does not stop at the exact location. Other than that, the luggage system takes some time to get connectivity with the phone and the GPS module needs around 10 minutes to triangulate the coordinates before the luggage can work. Since this is a prototype, there is still a lot of improvement that can be done. Apart from those flaws, the luggage can move autonomously by using one`s phone. Testing done also proves that this system can work most sets of phone, regardless of model (Android or Apple) and also work on devices such as Apple Ipad and tablets.

4. Conclusion

The experiments that have been conducted in this research have brought us to the conclusion that the aim and objective of the research that have been stated at the beginning of the work are accomplished. The experiment aims to design a product that enhances the travelling experience of modern-day travellers by adding features to conventional luggage have been fully understood and implemented within the scopes of the objectives of the research. A literature review of the study has been comprehensively developed throughout the project plan and this includes how the internal circuit is made together with the compartment box manufacturing. Furthermore, an explanation of material selection has also been provided to determine the overall body of the product. Finally, innovations are added to show the improvement that has been made compared to conventional luggage. Hopefully, with continued effort, this project can be strengthened through further research in some areas. Some things that can be considered are:

- Improvement in speed of our product by increasing its pace. This can be done by improving upgrading the DC motor and motor driver to a higher rated version.
- By making the component compartment smaller and lightweight, DML can also be made even more user friendly. This means that more storage space for belongings is available.
- A camera module that can track the user`s movement in real time and avoid obstacle can be implement, replacing the use of GPS module. This improves the auto-follow system tremendously.
- Improvement in quality, design and variety of the luggage by trying to implement this system in different type of luggage. This increases the appeal towards users.

Acknowledgement

This research was made possible by the Aircraft Maintenance Department's permission to use the laboratory facilities to conduct project testing. The authors would also like to thank Mr. Mohd Khairun Nizam bin Saadan, Miss Rosmawati and Madam Shalhayuni for their influence and counsel.

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