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Development of Autonomous Follow-me Robot, Robot Tool Cart Version 2 for Education

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Abstract - The Robot Tool Cart Version 2 (RTCV2) is designed based on a normal tool cart which is used to store the tools, equipment and some documents in the tool crib. Nowadays, the tool cart used in a hangar is non-autonomous technology, so a manpower is needed to push the tool cart to the workspace or back to the tool crib. This is of course a problem as it would exhaust the worker even before they need to do the task given to them. So, our project is to improve the normal tool cart with some features consists of IR4.0 technology which is Robotic features and Autonomous Technology. This product function is to follow the user to the desired location within the hangar area by using the Follow-me programme installed inside the Arduino that is used on the Robot Tool Cart Version 2 (RTCV2). Other than that, it will also keep the function as a normal tool cart, which is to keep all the tool, equipment and also document for the user to access either at the workspace or at the tool crib. The Robot Tool Cart Version 2 (RTCV2) is also an easy to operate technology where the user will only needed to control the the ON and OFF switch to operate it and shut it down. The Robot Tool Cart Version 2 (RTCV2) is also an easy maintenance product as it has an easy access to the wiring if there is maintenance needed to be done on the product. With all the function above this will surely ease the user to do their work/task efficiently. As it will decrease the amount of manpower needed just to push the tool cart to the workspace or back to the tool crib.

Keywords: RTCV2, Follow-Me Programme, Iot Application

1. Introduction

Tool Cart (Figure 1) that innovate is desirable in many applications for a mobile robot to track and follow a person [1]. The invention was invented for the purposes relates to a cart for transporting, storing, and supporting hand tools such as are employed by millwrights, plumbers, automotive mechanics, and the like. In aircraft maintenance, tool cart usage is very important as it acts as a tools

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and equipment keeping device, also as a carrier of the tools and equipment from the tool crib to the workspace, and vice versa. But there is a problem with that, as the user pushes the tool cart to the workspace or to the tool crib, a lot of energy and time is used. So, this is where the Robot Tool Cart Version 2 (RTCV2) came in, the Robot Tool Cart Version 2 was named as it is because a few innovation had been made to the original idea of a tool cart. The Robot Cart Version 2 (RTCV2) was implemented with a self moving device characteristic, thus making it seems like a robot itself. It use Arduino Uno which is also known as a micro-controller, that already comes with the 'follow-me programme' coding that has been uploaded to the Arduino Uno itself. For the coding to work as it is two types of sensor is needed to be applied in this project, which is the Ultrasonic sensor and the Infrared sensor, that is use to detect the distance between the user and the Robot Tool Cart Version 2 itself, and also to detect the proximity of the user path.

Figure 1: Tool Cart

2. Materials and Methods

The main body part of the Robot Tool Cart Version 2 was made by fibreglass weave mat combine with the epoxy and hardener resin that will make the composite material. The size of the Robot Tool Cart Version 2 is 15inch x 20inch x 18inch (length x width x height) for the main structural part to make it easily get through the bottom of the wing (for the light aircraft), and low or compact places. For the first drawer, the size part is 13inch x 18inch x 4inch (length x width x height). For the second drawer, the size part is 13inch x 18inch x 8inch (length x width x height). A pair of 12-volt DC motor with a 6inch wheel was installed to move the wheel that connected at the front right and front left side of the tool cart body. The speed and direction of the dc motor were controlled using the microcontroller, Arduino UNO which be determined by Ultrasonic sensor and Infrared sensor are module which then will send signal from the arduino to the L298N motor driver. The Robot Tool Cart Version 2 also has a door at the front of it, to make the maintenance work for the RTCV2 easier. Also the door is secured by a latch which then we lock using a padlock. The Robot Tool Cart Version 2 was designed with 2 drawers with different purposes for each drawer, where drawer 1 is used to keep the tools and drawer 2 is used to keep the document.

Figure 2: Robotic Tool Cart Version 2 (RTCV2)

Figure 3: Wiring Installed on RTCV2

Table 1: Comparison between Robot Tool Cart Version 1 & 2

Robot Tool Cart Version 1	Features	Robot Tool Cart Version 2
Aluminium	Material	Fibre Glass
Heavy	Weight	Light
15inch x 21inch x 25inch	Size	15inch x 20inch x 18inch
3km/h	Speed	5km/h
5kg	Max weight	10kg
High	Maintenance's Cost	Low

Robot Tool Cart Version 2 (RTCV2) have a lot of improvised features (Table1) that was used the old version's product as our references. The old version of the Robot Tool Cart Version 2 (RTCV2) was developed by using incongruous materials that makes the product having an issue in weight and speed movement. However, the size of old version's Robot Tool Cart Version 2 (RTCV2) was improvised in the new version because to make sure that it is compact and able to store it in the small area anytime and anywhere. The material that used on the Robot Tool Cart Version 2 (RTCV2) also improvised better than the old version that use the aluminium as the structure that obviously will give more force to the wheel during the moving process.

3. Results and Discussion

All components for Robot Tool Cart Version 2 (RTCV2) was successfully assembled as shown in Figure 3. The Robot Tool Cart Version 2 (RTCV2) moved by using an ultrasonic sensor to calculate the distances from the user while the infrared sensor component also used to calculate and analyze the body's heat of the user during the operation process of the Robot Tool Cart Version 2 (RTCV2). The movement of the Robot Tool Cart Version 2 (RTCV2) was supported by using the 12 volt motorcycle battery stored at the bottom of the Robot Tool Cart Version 2 (RTCV2) 's body. An arduio uno electrical component used to install the coding or order that influence the movement of the Robot Tool Cart Version 2 (RTCV2). The operation of this product also supported by the motor driver component. Moreover, this component has been replaced caused by an over voltage that flow in the circuit during the testing process. Function of this component is to controls the operation of the geared motor that attached together to the Robot Tool Cart Version 2 (RTCV2) and encourage it to perform effectively in the workplace. .

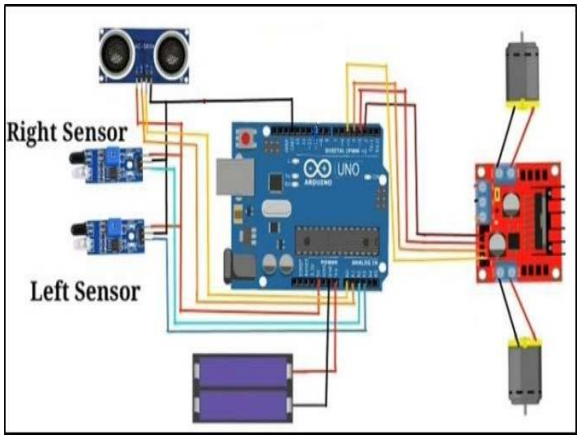

Figure 4: Circuit diagram for RTCV2

Figure 5 : Testing process of RTCV2

4. Conclusion

In this project, the Robot Tool Cart Version 2 (RTCV2) was developed to overcome the existing problem to decrease the use of manpower needed in the workshop or workplace that may cause injuries to the workers. Then, we also avoid any major injuries that always happen in the workplace caused by the negligence of the working during handling the tool in the workplace. The performance of the developed system has been successfully demonstrated. In addition, an ultrasonic sensor and two infrared sensor were deployed to determine the user movement, thus control the robot movement to keep following the user until it is switched 'OFF'.

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