ASSISTANT EYE

Product Specification Document

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Introduction

This document is prepared by the EyeCue Co. In this product specification report, technical goals and constraints of the product will be demonstrated. These details describe the main characteristics and patterns of the specified design of the product. The specifications depicted in an engineering format in this report are aimed to be a reliable guide to design and test the system. The product will be examined in terms of main features of the components, physical description of the product, desired formats of the data that the system will be using and the measurable requirements such as system time constraints.

The Product Specification

Size

Total size of the product will be approximately the same size as the wheelchair dimensions sine it is the biggest, the other components are thought to be located inside empty available spaces. There are several types of patients, so to be able to used by everyone, height to the ground should be 90 cm. for handles and 55cm. for seat, height of the back side should be 40cm. and seat width should be 45 cm. Since it will be used mostly indoor, the maximum overall width shouldn't exceed 75cm. to avoid situations like getting stuck to other stuff while moving. Other components such as batteries, circuit are planned to be located under the seat and DC motors will be located just behind of wheels.In addition to these components, the user will also interact with an apparatus that circles the above part of head and holds the camera for eye tracking. The apparatus's size can be adjustable for the user to arrange its comfort. Its dimensions are estimated to be 43 to 53 cm length, 2 cm height. Furthermore, camera distance to eye may be 10-15 cm so this means there is need an extra part that holds the camera in that apparatus. Camera should be as small as possible with its infrared feature.

Weight

There are several major factors that effects how total weight will be one of which is batteries weight that one of them is about 25 kg. Another factor is wheelchair own weight which is assumed to be at most 20kg so as to be carried if need. Additionally, there exist two DC motors with their approximately 6kg each. Last but not least factor is the user. His/her max kg is considered as 100kg. When these major parts are gathered together ;25kg x2(batteries) + 20kg(chair) + 6kg x2(DC motors) + 100(user) = 151 kg. (total) For convenience the total weight is expected to be 160kg since the system also includes a camera, a helmet and hardware.

User Interface In Engineering Terms

Initially, user will interface with wheelchair, a comfortable seat is waiting. After user sits, a special helmet that carries infrared camera that is used for detecting eye movements both nights and daylight and send data to the digital signal processor component will be placed to the user's head. Camera should carefully located in the way that its vision includes the pupil of eye since its major works is to detect the movements of the pupil of eye that can be either left or right. It is important to rec-

ognize that our system keeps its turn off position, in other words, the system is not started yet. On the wheelchair's suitable part, a button can be found. What this button has got to do with our system is that when the user presses it, it turns on the system and camera is going to detect the movement of eye. In order to understand whether the system in on or off, a led is placed on wheelchair. When LED is on that means the system is on and otherwise the system is off. After location and turning on processes are completed, now the user has the ability of control the movements of the wheelchair with his eye movements. User will move his/her eyes left or right to move the wheelchair left or right, and up or down to accelerate or slow down it. In order to stop system, not turn off, just closing eyelids for 3 seconds will work. If system wanted to be stop permanently, again the button should be pressed. It will also turn off led and by this way user understands that system is turned off. Apart from this, an emergency button is also placed on wheelchair for unexpected situations. When this button is pressed it will directly cuts the electricity of the system and make camera detection and wheelchair movements to stop.

Power Supply Specification

We are going to work on 12 v voltage on circuit. We are planning to draw voltage from battery, since our device does not have a plugged connection. Our mission is to move our vehicle with an acceptable level of acceleration. In order to achieve this goal at least 0,25 kW motor will suitable enough. We are going to use a 24v battery which will provide power to 3 different part of the circuit including, each wheels and the microprocessor with the collaboration of voltage regulator and camera.Because we will work with DC Motor, we are going to work with DC Current and the drawn current interval planning to be 0 A -14 A. 12v is the maximum limit of the operating voltage but the output voltage will be adjustable 18v ~ 26 v, and the device will not work below 5v, which we will use this limit as a switch in some point. We are planning to work with a battery which has at least 2 years life. Approximate battery dimensions are 10 cm / 5 cm / 20 cm.

Video or Audio Signal Characteristics

For eye-detection software, infrared camera will be used to enable the user drive the wheelchair even at night. Camera will capture 1 image for each 0.1 second to be used in the software. The format of the images will be JPEG, which preserves the quality of them while keeping the size of the files relatively small. The resolution of the camera will be at least 3.2 MP in order to provide 800px X 600px images. In order to optimize the processing power, the images taken may be cropped to smaller sizes, which contains the eye part of the picture. Discrete signals at the specific time intervals will be taken from the infrared camera with the frequency 10images/second. This frequency can be changed during the software test process to

adjust the responsiveness and accurateness of the eye-detection for developer's convenience. The images will be given to the processing unit to be analyzed in digital format.

Functions of the Product In Measurable Statements

When the start button of the system is pressed, the system will turn on in 4 seconds. Unlike the system start-up, the eye-detection process and response of the system accordingly must work in real-time efficiency. Therefore, after the movement of the eye is detected, the engine must response by turning, accelerating or slowing down in 1+/-0.5 second. On the other hand, emergency button on the wheelchair must be able to stop the movement in 0.4 seconds and shut down the whole system in 3 seconds. The infrared camera should take the picture in slightly less than 0.1 to be able to achieve 10images/second frequency.

The microprocessor must process and analyze two consequent images in 0.7+/-0.2 second in order to have time for engine to response on time. The angular speed of the turn of wheelchair must be at most 30o/second for the user comfort. The acceleration amount in speed up should be 0.5m/s2 to prevent the wheelchair from falling back. The acceleration amount in slowing should be -0.5m/s2 to prevent the user from falling out of the wheelchair. The engine should response to the signal from microprocessor in 0.3 second and must be eligible to stop immediately in case the emergency button is pressed without getting damaged. The signal must be transmitted from the microprocessor to the engine in less than 0.1 seconds with guaranteed delivery in each time. All components must be error-free and latency-free otherwise the user can end up with very dangerous situations while driving the wheelchair.

Conclusion

This report is prepared in order to demonstrate what the product specifications are. For better insight, product size, weight, user interface, power supply specification, video or audio signal characteristics, functions of products in measurable statements are explained in a detailed way. Each part is explained in a detailed manner and it creates more concrete ideas about the product in reader ‘s mind. All these specifications may be modified according to the changing design decisions as the project continues. Despite of the minor changes made to improve the system efficiency, the system will mainly be designed with the design patterns demonstrated in the report.

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