Application Group
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鋸台好聰明
Smart of Saw Table

隊伍名稱 鋸台好聰明
Smart of Saw Table
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研究領域
控制系統、模糊控制、智慧型控制、系統單晶片、崁入式系統及應用、即時控制、機電整合、機器人、綠色能源科技。

作品摘要

工業上許多器具都有一定的危險性，現代產業界為追求高生產效率，普遍將在工廠中的工具機或精密設備進行高速運作，如此來提升工作效率，但卻也伴隨一些安全上的問題產生。其中之一即為操作者因工具機所造成之傷殘問題，因此工具機安全係數的提升已是近年來熱門的研究方向。若是能在工業器具上加裝安全感測裝置，則危險性將會降低，工人在工廠裡工作時就能夠更加安心。這個主題主要是針對工業器具裡金屬的部分加裝人體感測器。木工鋸台所造成的意外為所有工廠器具中機率最高，輕則造成使用者受傷，重則會造成使用者遭受截肢，因此我們選用木工用的鋸台來安裝保護裝置，並設計了可以感測人體的感測裝置。實現了將感測裝置應用於鋸台上，而鋸片則成為感測器被用來擷取人體訊號，可判斷靠近鋸片的物體是待切割的木板還是操作者的手，來決定是否啟動保護裝置。同時，我們在鋸台系統裝上了升降機構，可用來調整鋸片高度。以下圖一為系統全貌與升降機構示意圖。

圖 1. 系統全貌與升降機構示意圖

本系統利用馬達的正反轉控制鋸片升降與轉動，幫助使用者避免危險發生。首先鋸台啟動時，會令馬達全速正轉，以供正常切割木頭使用。

在此同時，系統隨時接收感測到之身體訊號，由控制器判斷是否到達觸發保護機制的門檻，藉此判斷是否需要啟動保護裝置，否則系統還是處於正常工作狀態。以下圖二中灰色空間為警戒區，顯示了人體不可進入的區域。若人體進入警戒區或碰觸鋸片，則會觸發保護機制。

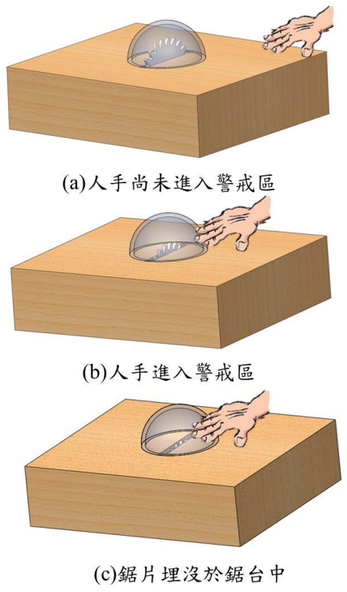

圖 2. 警戒區示意圖

利用以上功能，我們設計了一套保護機制，當其啟動後，控制器可使鋸片立刻停止轉動。並同時啟動鋸片升降機構，讓鋸片收起，令鋸片遠離使用者，進而達到保護目的。可有效預防人員傷害，在保障人員安全的方面有相當大的幫助。同時此系統具有快速復歸功能，可透過按鍵手動控制鋸片上升、下降，便可在觸發保護機制後，快速將下沉的鋸片復歸原位，不需要額外進行修復。

Abstract

Modern industry machine systems frequently require high-speed, highly accurate motion. Such motion is typically achieved using rotary motors and a mechanical transmission with reduction gears and a lead screw to improve the work efficiency. Therefore, many machine tools in the industry have certain risks.

In this work, the present system relates to a protective apparatus for a machine tool, in particular, to a protective apparatus for a machine tool for preventing an operational element of the machine tool in operation from harming the user. In cutting machine tools, the tool is one that easily can cut the user in operation, especially the machine tool for cutting wood. Either the professional technician or the do-it-yourself person easily gets hurt by using the machine tool. In order to increase the safety of using the machine tool, the traditional machine tool is configured with the protective apparatus.

This study provides a protective apparatus, and which is adapted for a cutting machine tool. The machine tool includes an operational element, a driving element, and a protective apparatus. Fig.3 shows the whole system.

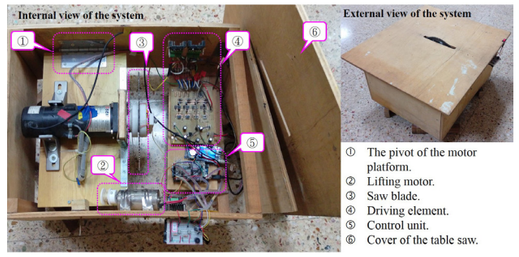

Fig 3. Overview of the whole system

The operational element is configured to a machine table. The driving element is mounted on the machine table. The protective apparatus includes a conducting unit, a capacitance sensor, and a control unit. The conducting unit contacts the operational element. The capacitance sensor is electrically connected to the conducting unit and used for sensing a capacitance of the conducting unit. The control unit is electrically connected to the capacitance sensor and the driving element. When the capacitance sensor determines that the capacitance is more than a predefined value, the capacitance sensor generates a stop signal to the control unit, and the control unit controls the driving element to stop driving the operational element according to the stop signal. The gray space in the following Fig.4 is the alert area, showing the area which human body does not allow to enter. If the human body enter the alert area or touch the saw blade, it will trigger the protective device.

Fig 4. Operation of the protective apparatus

To sum up, the proposed system provide a protective apparatus and a machine tool to enhance the security for the user using the cutting machine tool. When the protective device is triggered, the controller will a stop signal immediately to stop the saw blade. Meanwhile, the saw blade is retracted by the lifting mechanism. It makes the saw blade far away from the user so as to achieve the purpose of protection. The designed protective device can effectively prevent user from injury, and it has considerable help in ensuring the safety of users.