SCANING AND USE OF TACTILE INFORMATION IN AGRICULTURE BY USING TACTILE ACTIVATOR

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Abstract. Tactile activator system has been designed as an aid for the blind, but the whole system is applicable in any industry. For use in agriculture it is suitable as the control of machines, which are collecting individual information on the surrounding environment, which are processing and evaluating the positioning of objects in the perimeter sensor and information controlled by actuators. Sensing of information is done using a camera and laser measuring sensors. Evaluation is done by a control unit, which sends impulses to the actuators.

Keywords: electric motor, tactile activator, control unit, laser scanner space.

Introduction

Collection and use of tactile information in agriculture by the tactile activator is based on the thesis “Tactile activator”.

The tactile activator is a device that helps blind people with the orientation and movement in space. It was designed by the blind themselves and some centers for the blind in order to understand their needs and possibilities of using this device better. The tactile activator is a system that consists of several parts.

Camera

The camera is placed on the head and the blind will be filmed in a straight line before the blind, panned to the area in front of him. Its dimensions are miniaturized to impede the movement and unnecessary load of the people who will wear it. Its task will be to collect the data creating a video recording or photographs. If the camera will capture video footage, this video will have to use the necessary software to convert the individual images, which will be used. The second option is to create images instantly with some frequency in real-time imaging to accelerate throughout their processing. The advantage of video capture is that they make the images more accurately, show the situation before the pedestrian. CMUcam3 camera parameters ARM7TDMI processor (32-bit, RISC) is used. The main processor is the NXP LPC2106 (32-bit single-chip microcontrollers, 128 kBISP/IAP with 16/32/64 kB RAM) connected to an Omnivision CMOS sensor. The sensor offers a wide range of image correction directly on the chip (AGC, AWB, setting the exposure time, brightness adjustment, contrast). Custom code can be developed for using the GNU toolchain CMUcam3. The maximum resolution is 352x288 pixels at up to 50 fps. The big advantage of this chip is the low energy consumption. Power is stored in batteries in the camera case (Fig. 1).

Fig. 1. **LMS100 Laser Measurement System**

Tactile activator

The tactile activator and its technical part (Fig. 2 – 3) consists of a plastic chassis that protects its contents from environmental influences and damage. It acts as a housing for PCB and components. Inside the plastic chassis there is the PCB, which is equipped with electric motors, controllers and other electric components. The electric motors used are Maxon, Motor lat 30200 EC 10, 0.2 W. The engine works with alternating current, it has one end shaft and ball bearings.

All engines will spin at the same speed, according to the signal that is given by the control unit. The dynamic characteristics of the electric motors are the same as the commutator engines, but their lifetime is longer, it is not dependent on the brush wear and commutator, but only on the lifetime of the ball bearings. Dynamic properties are important for us because the speed of starting and stopping the engine is essential for accuracy of the transmission environment information for the blind pedestrians. Acceleration and suspension will be proportionate to the size of the eccentric, creating vibrations. Motor selected has very favorable dynamic properties for our application as this motor is able to rev up to 70 % of the maximum speed for 86 ms and 100 % performance should reach to 122 milliseconds. These values will affect dimensions and weight of used eccentric mass, which will be placed on the shaft of electric motor and will cause the vibration of the engine. The electric motor will vibrate the plastic ring to which it will be fixed and will transmit information. The control unit or other system components are not affected by vibrations by mason flexible connection between the motor and the control unit.

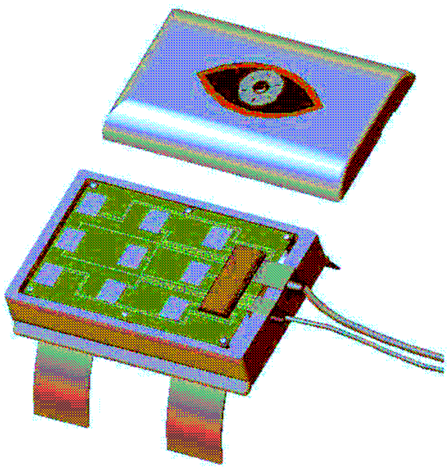

Fig. 2. **Tactile activator**

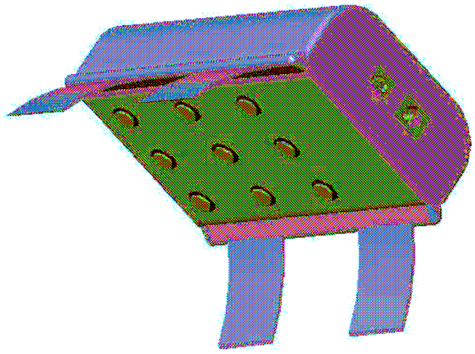

Fig. 3. **Tactile activator II**

The control unit

The control unit 1-Q-EC Amplifier DEC module 24/2 has been chosen (Fig. 4). This unit is fully compatible with the selected engines. The units are PCB equipped with electric components and seventeen pins. Individual pins are numbered and each has its function. The pins are used to connect PCB Tactile activator. The PCB must have seventeen drill holes into which the control unit is fitted. The pins with the control unit PCB connect activator, to ensure their conductivity and solid casting. This prevents bad improper functioning of the unit and placing the device into space. This connection is functionally safe and quality workmanship ensures error-free functionality of the assembly. The control unit controls the electric motor. By default, the engine will spin at the speed 500 revolutions per second (Fig. 5). A lower speed motor for its construction is impossible. Changing the speed of rotation is performed by calculating the operating values and adjusting the voltage. Speed control is done by setting the values of pins on the control unit. Pin No. 13 controls the electric motor on and off. On this pin the control signal from the microprocessor will be brought. Once the control unit receives a pulse, it immediately respond and puts the appropriate motor into operation. Pin 6 is connected to pin 17 and the setup will determine the speed of rotation of the eccentric. The activator as a tactile system was so designed and developed for use in normal operation and to facilitate the movement of the blind. However, you can easily incorporate it into industrial use in agriculture, navigation and control as the control unit. This system was expanded to include laser sensor space and is customizable and compatible with other systems.

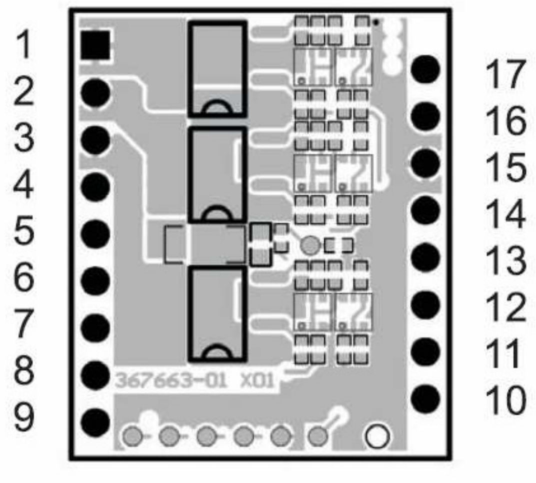

Fig. 4. **Control unit**

The tactile activator is a device that collects, processes, evaluates, and translates the information tactile signal. The device consists of a laser sensor space, the control unit and controls. LMS100 Laser Measurement System/111/151 is a non-conventional broadband detection system that allows the reflected optical beam control almost circular area with a diameter of over 20 meters. Usually, the angular width of the space is used by 270 degrees with an accuracy of 0.25 or 0.5 degrees during the scanning frequency of 25 or 50 Hz. LMS uses for operation up to 20 W.

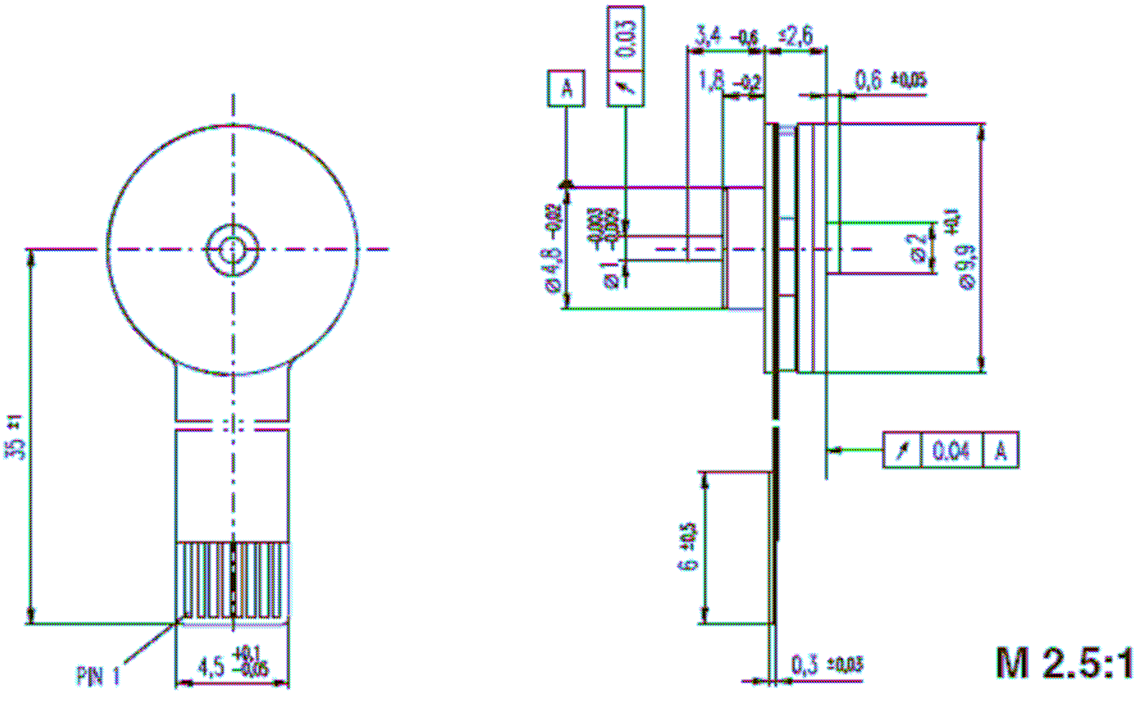

Fig. 5. **Electric engine**

The laser measuring system for normal operation works automatically without operator intervention. Interactive communication is done using the included configuration software SOPAS ET. The wavelength beam ranges from 892 nm to 915 nm, which is safe if the beam accidentally hits the eye. The laser sensor does not function solely as a transmitter/receiver of the reflected beam as in classic diffuse optical sensors, but there is also directly measured the distance of objects from the sensor by measuring time of flight. The sensor transmits a beam of light still, but at regular intervals generates only light from a laser pulse and the internal electronics of the expected arrival of the optical receiver and calculates the elapsed time. If the reflected pulse comes, time is deducted, thereby assessing the distance. Where to send the next pulse reflection comes, there is no sensor in the object range. This mode is also implemented gradually throughout the scanned area at an angle of 270 degrees to 0.25 degrees increments, which is posted to 1080 pulses. The width of the scanning area can be arbitrarily set so that you can only scan accurately the defined simplicity. The sensor will be placed firmly on the front of mechanization equipment, making it possible to accurately determine the direction in which the single pulse was sent and the answer, which can accurately detect the obstacle and determine its distance. All data will be transported from the sensor to the control unit which processes the data and evaluates exactly in which direction and how far away an obstacle is. After evaluating the results of the control unit it sends them to the individual outputs of the control pulses and manages a specific preset active element. If we consider mechanisation machines, this can control the direction and speed of movement.

Conclusions

Using the tactile activator adapted for the blind will serve a large group of people and help them improve their lives. When used in agriculture it saves the time and costs and increases the work efficiency.

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