Development of Control System for *Keropok Keping* Drying Machine

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Abstract. This research is focused on the development of a control system for the *keropok keping* drying machine by using programmable logic controller (PLC) as the controller. The control panel and human machine interface (HMI) were developed for the machine. Experimental study was conducted to validate the HMI speed data by the control panel speed display. The evaluation of the duty cycle (%) and current flow (amp) effect to the motor and fan speed were also conducted. The results showed that around 1 - 30 % and 1 - 3 % differences of the speed readings were recorded by the HMI for the motor and fan respectively. The percentage difference needs to be controlled as small as possible to ensure the HMI speed readings are more accurate. The linearity of the current flow curve to all duty cycle can be observed. The flow (amp) increases when the speed of dryer motor and fan increases. The development of the control system is expected to improve the operation of the *keropok keping* drying machine.

1 Introduction

Keropok keping is a dried crispy food product relatively popular in Malaysia and South-East Asian countries. Currently, its manufacturing is mostly practiced in small scale industry [1]. In Malaysia, the *keropok keping* industry is widely operated in coastal areas in the state of Terengganu, Kelantan, Johor, Kedah and some parts of Pahang due to high seafood supply, high temperature and windy area that contribute to the sustainability of the industries [3].

Ingredients for making of the *keropok keping* are starch or sago flour, fish, squid, prawn or shrimp and a little of seasoning such as pepper, garlic, salt, sugar and monosodium glutamate (MSG). All the ingredients are mixed by using a mixer to obtain dough. The dough is formed into a cylindrical shape with a diameter around 6 to 10 cm and then is cooked by boiling or steaming. The cooked dough is drained, cooled and cut into the thin slices with thickness around 3 mm and then is dried under the sunlight [2].

The dried *keropok keping* obtained is considered as a half-finished product or an intermediate product. Then, the *keropok keping* has to be fried in hot oil to obtain the edible puffed cracker. In *keropok keping* industries, most of the production processes are implemented by semi-automated machines such as a mixer, grinding and slicing machine. However, the drying process still uses the traditional method. In existing method, the *keropok* is arranged and dried on a drying board called *pemidai* under the sunlight. The *keropok keping* is exposed to the heat and surrounding wind to be dried [3]. In order to improve the drying process, new rotary type of *keropok keping* drying machine was invented as shown in Figure 1.

In general machine operation, *keropok* with high level moisture is arranged and hold by a special holder inside the rotary drum which is the drum and supported by four rubber tires. The gear motor is utilized to transmit power to rotate the drum to produce anti-clockwise rotation. Air generated by the fan is flowing to vaporize the water from the *keropok keping* inside the rotary drum. The process is continuously performed until the moisture level in the *keropok keping* is considered low and suitable for packaging [3]

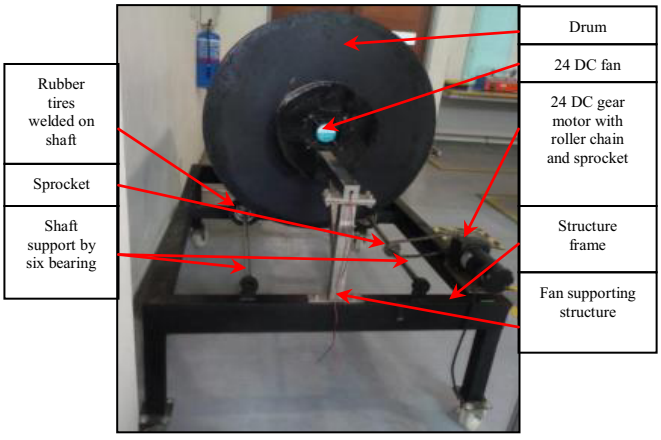

Figure 1: Rotary type of *keropok keping* drying machine [3]

However, the machine does not have any special system to control the dryer operation. All tools and machines need an appropriate control system to work. Otherwise it will be difficult to complete the task designation accurately. Control system is needed in order to guide, instruct and regulate tools and machines.

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