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Implementation of Automatic In-store Dryer for Improving Agriculture Product

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Abstract. The post-harvest agricultural products handling is important to improve quality and to reduce yield loss Shallot is one of perishable agricultural commodities. Inappropriate post-harvest handling of onion can causes loss in weight, damage bulbs because of rotten, moldy, and new shoots grow. The traditional process of drying agricultural commodities can takes around 7-9 days under direct sunlight and 3-4 weeks depending on weather conditions when restore in the drying room. This causes more time for post-harvest processing and farmers to be needed. The installation of the automatic instore dryer provides a solution where the drying time is less than a week with the level of humidity and temperature are based to the target set point and not too dependent on outdoor weather. While temperature conditions under regulated temperature, the heating process uses light bulb while the air circulation inside the instore is using the exhaust. The output signal of the controller will activate the incandescent and exhaust lights based on the difference between the sensing temperature and humidity sensors installed in the room and set point.

1. Introduction

The post-harvest agricultural products handling is important to improve quality and to reduce yield loss. Shallot is one of perishable agricultural commodities. Inapproopriate post-harvest handling of shallot can causes loss in weight, damage bulbs because of rotten, moldy, and new shoots grow. Handling the post-harvest technology of shallots by farmers still carried out traditionally so that the yield loss is quite high. Hanging on bamboo/wood in open place exposed by the direct sunlight is a traditional method to dry the shallot which take 7-9 days even more due to weather. With traditional method the shallot can loss 25% of its weight.

Therefore, efforts to improve handling technology post-harvest shallots aims to produce the good shallots and appropriate/right conditions to be consumed immediately. In-store dryer is a room/house which consist of several shelves, and heat saving material. This technology needs to be control automatically where the need of human monitoring less than manual method.

There are two parameter inside in-store dryer that need to be control so the losses can be less. First is humidity, where the range humidity in-store dryer : 41%-52%. The second is the temperature where the range temperature : 39-48 °C. Target of drying with these range number will produce dry shallot in less a week or approximately 3 days.

2. Design and Implementation

Target of the design and implementation of in-store dryer will be used for shallot farmer with the scale as seen in figure 1witdh dimension 2.4 m x 2m. Each row consists of three coloumn where there is a lamp and a sensor of temperature and humidity of each colomn. There are also two exhaust in and out for circulation inside the dryer.

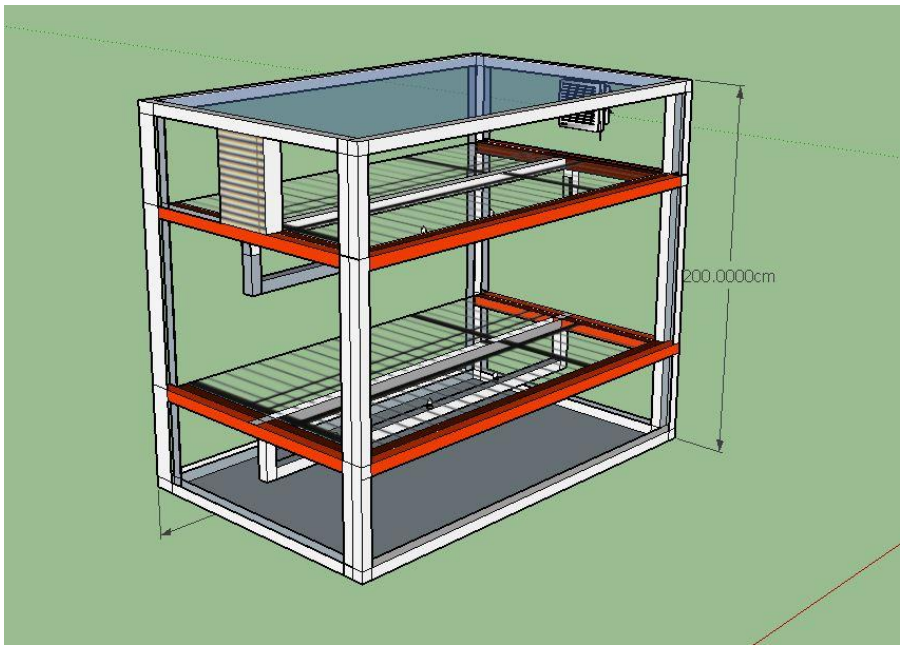

Figure 1. Design of in-store dryer room

Electrical components of the system can be found in figure 2. DHT sensors for sensing temperature and humidty will send the output signal to microcontroller. The difference between set point humidity/ temperature with current signal will determine control signal from microcontroller to the exhaust fan and lamp.

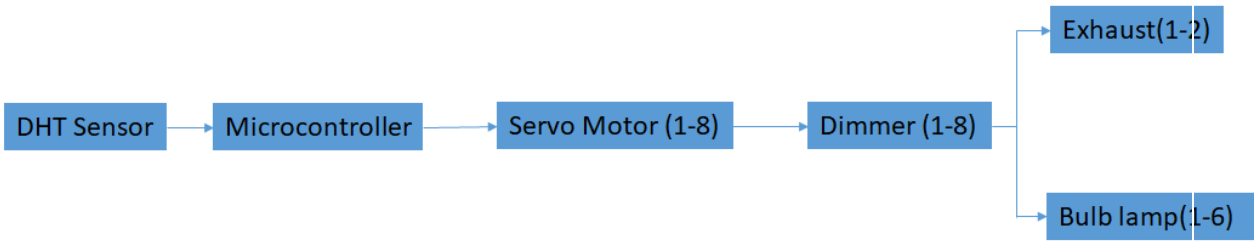

Figure 2. Electrical hardware of automatic in-store dryer

3. Measurement

Table 1: Results of temperature and humidity outside in-store dryer

t(minute)	T(°C)	H(%)	weather	Time
0	47,9	27	shine	09.00 AM
60	37,5	43	cloudy	10.00 AM

The result of table 1 can be compare to inside in-store dryer in table 2 and table 3. Result of Table 2 when the measurement starts from 11.11 PM to 03.11AM while result of Table 3 starts from 01.00 AM to 06.00 AM. The measurement is done in rain season where in November the air more humid than months before.

Table 2: Results of temperature and humidity inside in-store dryer with 6 Lamp (60 Watt) is ON, while the exhaust is OFF

t(menit)	T(°C)						H(%)					
	T1	T2	T3	T4	T5	T6	H1	H2	H3	H4	H5	H6
t0	25,70	25,70	25,50	25,50	25,80	25,50	99,90	99,90	99,90	99,90	99,90	99,90
t60	34,50	35,50	33,70	33,90	34,20	33,30	66,30	61,20	90,00	75,90	77,40	73,20
t120	35,40	36,40	34,60	34,60	35,00	34,10	59,60	55,80	78,00	69,90	71,20	67,30
t180	35,20	36,20	34,30	34,50	34,90	34,00	59,50	55,10	76,30	68,90	70,00	66,00
t240	35,40	36,40	35,20	25,20	34,80	34,40	59,40	55,00	74,20	67,80	69,80	65,90

Target of temperature and humidity achieve when using 6 bulb lamp of 100 Watt where in 60 minutes the temperature is 39.3 °C whether the humidity is hard to achieve in midnight of rain season. It can be seen in Table 2.

Table 3: Results of temperature and humidity inside in-store dryer with 6 Lamp (100 Watt) is ON, while the exhaust is OFF

t(menit)	T(°C)						H(%)					
	T1	T2	T3	T4	T5	T6	H1	H2	H3	H4	H5	H6
t0	25,30	24,70	24,80	25,00	25,30	24,90	99,90	99,90	99,90	99,90	99,90	99,90
t60	37,70	39,30	36,60	37,40	37,90	36,60	62,70	56,70	88,30	69,30	72,10	68,30
t120	38,70	40,70	38,00	38,70	39,10	37,70	58,70	48,70	69,20	59,60	62,90	59,00
t300	42,30	42,30	39,70	39,80	40,40	39,00	44,70	44,70	60,40	55,20	58,00	54,50

By the result, applying proportional controller to the system will accelerate temperature and humidity inside instore dryer to the target of setpoint.

4. Conclusion

- The using of automatic system will purpose drying fast shallot to minimize quantity and quality loss
- There is significant increment in temperature using lamp and closed room (in-store dryer)

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References

BPS Minahasa, 2016, Luas panen dan produksi bawang merah menurut kecamatan di Kabupaen Minahasa: https://minahasakab.bps.go.id/statictable, akses tanggal: 16 Februari 2018.

BPS Minahasa,2016, Statistik Daerah Kecamatan Tompaso Barat, BPS Kabupaten Minahasa.

Haris F. Aldila, A. Fariyanti, N. Tinaprilla, 2015, Analisis Profitabilitas Usahatani Bawang Merah Berdasarkan Musim Di Tiga Kabupaten Sentra Produksi di Indonesia

Eka F, Teknik Pengeringan untuk Meningkatkan mutu Bawang Merah (Allium cepa L) di Provinsi Aceh: http://nad.litbang.pertanian.go.id, tanggal akses: 16 Februari 2018.

Erwin, 2015, Efisiensi Pemasaran Bawang Merah di Desa Tonswer Kecamatan Tompaso Barat Kabupaten Minahasa, ASE Volume 11 No. 2A.