

TECHNOLOGY MANAGEMENT OF SUNFLOWER SEED PROCESSING INDUSTRIAL AS A SUSTAINABLE HEALTH PRODUCT

VIEQI RAKHMA WULAN, S.E., M.MT

Management, Department of Economy, PGRI Adi Buana Surabaya University

Dukuh Menanggal XII/4 Surabaya

e-mail: v.qira.khma@gmail.com

ABSTRACT

Today, herbal products are so phenomena in the society. Technology is so important in this industry. The benefits and the efficacy that contained in this product can be maintained if the technology can be managed properly. This research present how the technology management is applied in the herbal product industry. This research is descriptive qualitative with sunflower seed oil as object and Sunflower CV. as subject. From this research found that the owner mostly use natural process and enough science technology to produce the herbal product. The owner do the management very well so the product really naturalness and usefulness. By combining the technology of science, equipment and machines which is self created, the efficacy of sunflower seed are well preserved.

Keywords: *Technology, Technology Management, Sunflower seed oil.*

1. INTRODUCTION

Activities management are not only limited on company activity but also outside the company. Management activities are very abroad including in the field of technology. Today, it seems difficult to separate engineering and management activities (Nazaruddin, 2008). This is because the role of technology is so important for the company's life cycle, including the sunflower seed processing industry into health product. Wrong technology can reduce the efficacy of sunflower seed or may even be life-threatening to the sufferers. Therefore, technology management is needed.

Many people do not know the usefulness of the flower that has the latin name of *Helianthus Annuus* Linn and belong to the family of composite (Asteraceae). The function of Sunflower not only as an ornamental plant but also has many benefits. According to Cholid & Balittas (2009) sunflower can be utilized as foodstuff, biofuel, health and medicine, and other added value.

The benefit of health and medicine taken from the oil. This oil can be used as an anti aging skin care, either in supplements form or pure oil form that used for cooking. The sunflower seed has a balanced nutritional composition that is beneficial to body's health, such as vitamin A, Vitamin E and good fats (omega-6) so that this oil can be used internally and externally for the body (Fahrudin, 2015).

The concept of healthy lifestyle "back to nature" done by the community. This movement is also supported by WHO through their programs "Traditional Medicine Strategy". WHO also signed MOU, one of them is with India to promote traditional medicine. Sunflower seed oil can be an alternative. The efficacy of sunflower seed oil can be perceived by the society if technology done properly. Therefore, technology management is required. Besides to improve business efficiency, the existence of technology management also impact on improving business competitiveness and innovation creation.

Sunflower CV. is one of the company that produce health product with sunflower seed oil as raw materials. This CV was established in 2003, based in Blitar. The product is sunflower seed oil which then formulated into various products. This research focuses on how the company implements management of technology in the process of producing sunflower seed oil.

2. METHODOLOGY

This research is a qualitative research so the test is done without using statistical tools to find meaning. The method is descriptive method. This method is used by searching the elements, characteristic, to illustrate why the phenomenon occurs. This method is also used to get in-depth data and contains the meaning of the actual data and exact data (Suryana, 2010). This method begins by collecting data, analyzing data and interpreting it.

The variables in this research are : sunflower seed oil, technology and technology management. Based on some understanding of variables, Setyawan (2008) concluded that the variable is an attribute or character or value of people, objects or activities that have certain variations set by the researchers to be studied and drawn conclusions.

This research uses qualitative approach. In this research did not use population an sample because this research departs from certain cases that exist in certain social situation in which case the research departs from the role of technology and application of technology management on the Sunflower CV. This is like what was said by spradley that cited by Sugiyono (2011) which uses the term of population as a “social situation” that consisting of three elements, namely: place, actors and activity that interact synergistically.

Data in this research consist of primary and secondary data. Primary data were collected through a basic theory search of technology management to support the processing of research. It starts from collecting all the relevant literature and studying the researches that have been done before. The output of this literature study is the collection of relevant references with problem formulation that is about the application of appropriate technology management to the sunflower seed processing industry as a sustainable health product. Secondary data were collected through direct observation and depth interviews with the owners on sunflower CV. Esterberg (2002) suggest that there are several types of interviews, including structured, semi-structured and unstructured. In this research use semi-structured and unstructured interviews so then interviewee can be more free to express their opinions and interviewer can get the information beyond the guide question but it is still in the research area.

The method of qualitative data analysis according to Miles and Huberman, as quoted Sutopo and Arief (2010) are three technique there are data reduction, data presentation and conclusion,.

3. RESULTS (Technology Management in Sunflower CV.)

3.1 Technology management definition

The word **Technology** comes from the Greek ‘Technology’. Where *Techno* means art/craft and *Logia* means science, theory, study of something or branch of knowledge of a discipline. Technology can also mean entity that are useful to humans like machines, but can also include a wider range such system, organizational method and technique (Dj, 2009).

Technology refers to several things (Wanridz, 2015) :

- a. Application of equipment and method for the production process
- b. Method of applying knowledge or technical equipment
- c. Machines and systems are considered as a set
- d. A set of knowledge of a society or culture that is practical (applied)

Technology has some definition based on reasoning of the experts. Dosenit.com (2015) conclude the technology as follows:

- a. Technology is a practical method used to create something useful and can be used repeatedly.
- b. Technology is created by humans, many related to the practical activities that humans do daily.
- c. Creation and development of a technology is for the purpose of human development where technology was deliberately created to help facilitate the job and human activities.
- d. The basic of science that possessed by technology is scientific science which is a practical version.
- e. Every technology can be created and also developed in accordance with the needs and also the capabilities of humans. The limits of a technology are just human thoughts. As long as humans can look for new ideas then technology development will never stop.

Still according Dosenit.com (2015), some examples of technology are:

- Information technology
- Mechanical and industrial technology
- Computer technology
- Other technologies

If connected with management, then technology management is a discipline that bridges the field of engineering and science with the field of management devoted to planning, development and implementation of

technology in order to achieve the strategic and operational goals of an organization. Thus described as follows (Khalil, 2005) :

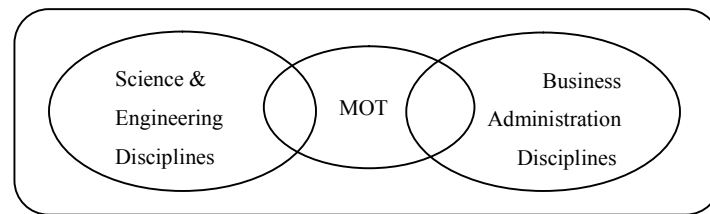


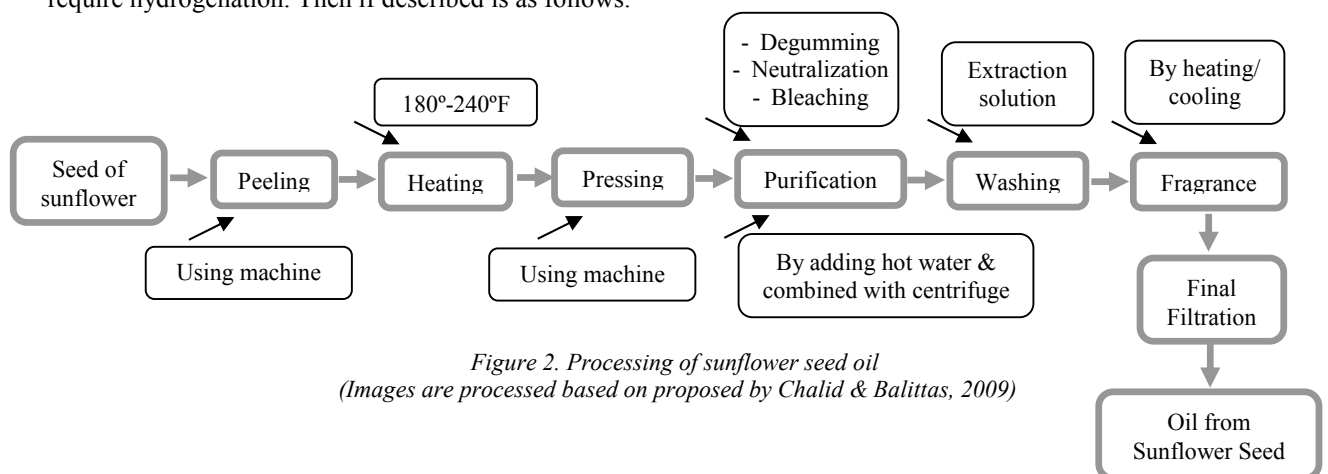
Figure 1. Technology Management

According Sinaga (2010) Management is the process of planning, setting, supervising, and controlling. Or often we hear about management abbreviation is POAC (Planning, Organizing, Actuating, Controlling). The purpose of applying technology management is to create and/or add value to the company through technology either self-created or obtained from the outside. Creation/enhancement of value can be done through the creation of business, the creation/improvement of products and services or the creation /improvement of processes (Nazaruddin, 2008).

So it can be concluded that doing technology management means managing a technology starting from planning, Organizing, Actuating and Controlling the technology to create and add value to the company in order to achieve the strategic and operational goals of an organization.

3.3 Processing of sunflower seed oil

Cholid & Balittas (2009) suggests seed peeled with peeling machine before pressed and then heated 180°-240° F then mechanically pressed using expeller. The next stage is placed in the process of extraction solvent to separate the rest of the oil by washing chemically. The oil that produced is exported as crude oil or refined for local consumption. The purification process includes degumming process by adding hot water and combined with a centrifuge. The oil is then washed and given fragrance by the heating/cooling process and the final filtration does not require hydrogenation. Then if described is as follows:



*Figure 2. Processing of sunflower seed oil
(Images are processed based on proposed by Chalid & Balittas, 2009)*

Almost same with Chalid & Balittas, Endah (2013) also described the processing of sunflower seed into oil and flour product through the process of drying, peeling, cleaning and sorting, smoothing and pressing the seed with screw press (cold pressing). The process of drying and sorting using the machine while other process without machine. Endah continued, for oil after produced from screw press machine must be purified first. The purification process includes degumming, neutralization and bleaching. Oil, flour, and other products are subsequently consumed for health improvement. If described is as follows:

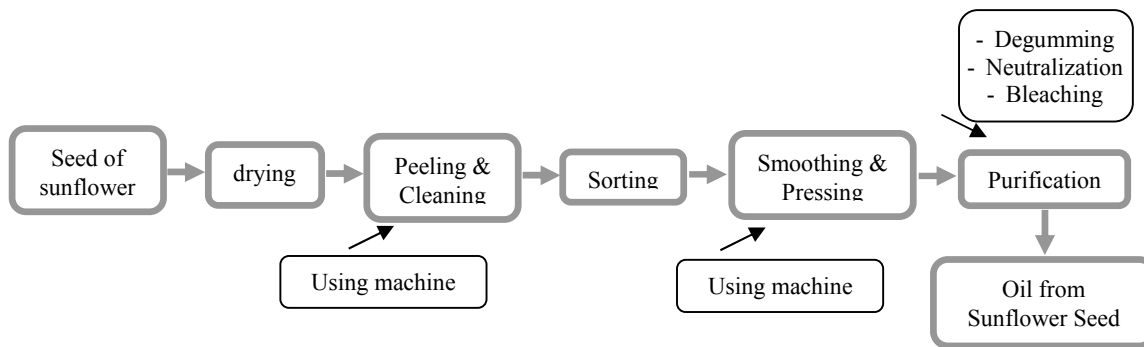


Figure 3. Processing of sunflower seed oil
 (Images are processed based on proposed by Endah, 2013)

Some of the processes that need to be explained are as follows:

- **Purification**, through different several process in each company, but generally there are :
 1. Degumming. The process of separating gum (sap), by dehydration gum then followed by the centrifugation process with add chemicals that can absorb water (Ilham, et al, 2013)
 2. Neutralization. The process of separating free fat acid from oil or fats. It can using Caustic Soda, Natrium Carbonate, Solvent Extraction, Ethanol Amine and Ammonia (Ilham, et al, 2013).
 3. Bleaching. The process to remove undesirable dyestuffs in oil. It can using absorbent or chemicals (Ilham, et al, 2013).
- **Extraction** is the process of separating a substance from its mixture by dividing a solute to taking the solute from one solvent to the other solvent. (Ilham, et al, 2013). He continued for extraction, oil solvents or fats commonly used are petroleum ether, gasoline carbon disulfide, carbon tetra chloride, benzene and n-hexane. Caesari and Martadilla (2010) explained about the manufacture of make cooking oil from sunflower seed using extraction from n-hexane solvent. Lukito A., et al, (2004) also conducted comparative experiment of extraction sunflower seed oil using n-hexane and ethanol.

3.4 Implementation technology management in the company

From some processing of making sunflower seed oil above shows that the process is susceptible to using chemicals. Although used in small quantities according standard but chemicals remain dangerous, moreover as a medicine, it will be consumed in the longterm and continuously. Besides, by the process of heating or cooling can damage the substances that are in sunflower seed. Gunawan (2009) said that “the best oil is processed without heating or cold press”

Just for example, caustic soda (NaOH) in neutralization process. Juanda (2011) suggest caustic soda if contact with the skin causes irritation and burns and if swallowed, caustic soda can be fatal. Another example is n-hexane as extraction solvent. Outbreaks of nerve disorders that hit shoe workers in Japan and Italy. Doctors determining the disease was caused by the workers breathing air containing high concentrations of n-hexane that came from glues and solvents the workers used in assembling the shoes (US Department of health and human services, 1999). In Material Safety Data Sheet (2008) identification that n-hexane is danger of serious damage to health by prolonged exposure through inhalation. Breathing vapors may cause drowsiness and dizziness. Causes eye and skin irritation. Possible risk of impaired fertility. Aspiration hazard if swallowed. Can enter lungs and cause damage, also dangerous for blood, central nervous system, liver, and respiratory system.

Sunflower CV innovates how to keep the product still original, natural, nutritious, so the body remains healthy. They combining the simple tools and machine (own creation) with his knowledge, created a natural health products and safe to consume continuously. The process is as shown in figure 4.

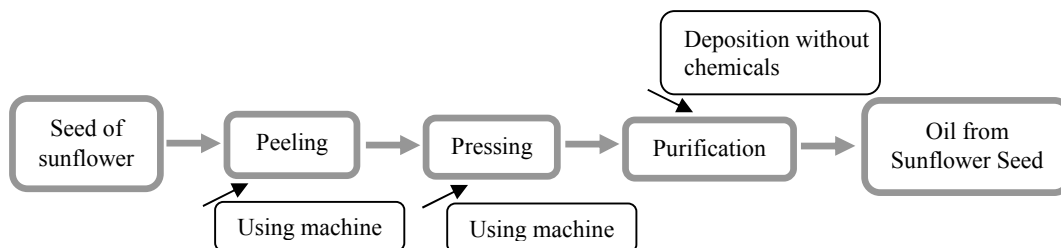
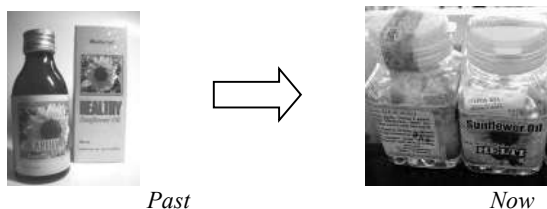


Figure 4. Processing of sunflower seed oil
 (Images are processed based on interview result to the owner)

The picture shows that the owner does not use chemical process at all in the manufacture of sunflower seed oil, neither in the purification nor in the extraction process until it becomes oil. According to the owner, in addition to maintaining health welfare, the process of such as degumming is unnecessary. It is because after conducted a number of research by the owner, evidently, gum from sunflower seed, also efficacious. Therefore, the gum doesn't need to be removed.

Although it doesn't use a chemical process at all, pure sunflower seed oil can last up to 4 years (based on the results of the research owner). In his research, he also found, if sunflower seed oil splashed on dead rats then the oil is taken again, the bacteria becomes disappear and not in oil. This indicates that the oil of sunflower seed can prevent the entry of bacteria.

In a day, sunflower CV produces about 500-700 bottles, marketed almost all regions of Indonesia and abroad (England, America). In the packaging, sunflower CV also innovate, initially, they using box now without box.



4. CONCLUSION

The owner of Sunflower CV has been doing technology management activities very well. There are apply technology as needed. The owner are wise enough and able to manage technology kindly. Because this is a herbal product industry. Where the product used both inside and outside the body. Inside by absorbed and outside by applied to the body. If wrong or over technology, the danger can be life-threatening.

Such cases of making oil from sunflower seed, although there is a technology to separate 2 or more mixtures using chemicals but in the process of medicine, chemicals are should not be used at all. Because, even though consumed in small quantities but if repeatedly, it will accumulate in the body.

So, in technology management, before decide what technology will be used, it need to be identified, if the output of production process is a product that will be consumed, then removed technology that using chemicals. The steps are as follows:

1. Product identification
 - a. Product consumed by the body, or
 - b. Product are not consumed by the body, or
 - c. Services
2. Especially for product that consumed by the body (either absorbed or applied to the body), make sure, raw materials and production processes without chemicals at all.
3. Management process begins, for example starts from planning
Planning of technology,
 - What technology will be used, equipment, machines, science, computer or another technology.
 - How technology is used in the production process.
 - Quality of technology safety.
 - Pay attention with limitation/weaknesses of technology that will be used.
4. Management process is done from the beginning of production until packaging and distribution

REFERENCES

- [1] Caesari, Niratia Handini & Martadilla, Muhammad Reza. (2010). Pabrik Minyak Goreng Cooking Oil dari Biji Bunga Matahari *Helianthus Annus L.* Dengan Proses Ekstraksi Solvent. Digital Library ITS. <http://digilib.its.ac.id/ITS-NonDegree-3100010041105/12902> [online] 02 Mei 2017
- [2] Cholid, Mohammad & Balittas. (2009). Pemanfaatan produk bunga matahari (*Helianthus annuus L.*) sebagai bahan pangan, biofuel dan nilai tambah lainnya. Info Tek Perkebunan Vol. 1 no. 10. Pusat Penelitian dan Pengembangan Perkebunan, Bogor. http://perkebunan.litbang.pertanian.go.id/wp-content/uploads/2010/01/perkebunan_infotekbun_1102009-2.pdf [online], 04 Juni 2016.
- [3] Dj, Ari. (2009). Pengertian Teknologi. <https://arydj.files.wordpress.com/2009/12/01-pengertian-teknologi.pdf> [online], 01 Mei 2017.

- [4] Dosenit.com. (2015). 16 Pengertian Teknologi Menurut Para Ahli. <http://dosenit.com/kuliah-it/teknologi-informasi/pengertian-teknologi-menurut-para-ahli> [online] 11 June 2017.
- [5] Esterberg, Kristin G. (2002). *Qualitative Methods in Social Research*. Boston : McGraw-Hill.
- [6] Fahrudin, Imam. (2015). 7 manfaat minyak bunga matahari untuk tubuh. <http://www.manfaatcaramengatasi.com/2015/11/manfaat-minyak-bunga-matahari.html#more> [online] 23 Oktober 2016.
- [7] Gunawan, Andang W. (2009). *Food Combining*. Jakarta : PT. Gramedia Pustaka Utama
- [8] Ilham, Arief Maulana, et al. (2013). *Pengilangan Minyak Nabati*. Makalah. Jurusan Teknik Kimia Fakultas Teknik Universitas Riau, Pekanbaru
- [9] Juanda, Agus. (2011). Caustic Soda : Bahaya Kesehatan. <http://www.kesehatankerja.com/CAUSTIC%20SODA.html> [online]
- [10] Khalil, Tarek M. (2005). *Customized Management of Technology*. Europe : McGraw-Hill.
- [11] Lukito A., Yanuar, et al. (2004). *Proses Pembuatan Minyak Biji Bunga Matahari Menggunakan Metode Ekstraksi-Destilasi Dengan Pelarut n-Hexan dan Pelarut Etanol*. Prosiding Seminar Nasional Rekayasa Kimia dan Proses. ISSN: 1411-4216
- [12] Material Safety Date Sheet. (2008). N-Hexane. <http://fscimage.fishersci.com/msds/00731.htm> [online]
- [13] Miarso. (2007). *Menyemai Benih Teknologi Pendidikan*. Jakarta : Pustekom Dinas.
- [14] Naisbitt. (2002). *High Tech High Touch*. Bandung : Mizan.
- [15] Nazaruddin. (2008). *Manajemen Teknologi*. Yogyakarta : Graha Ilmu
- [16] Setyawan, Dodiet Aditya. (2008). *Variabel Penelitian dan Definisi Operasional*. Hand Out Mata Kuliah Metodologi Research. Poltekkes Surakarta. <https://adityasetyawan.files.wordpress.com/2009/01/variable-penelitian-dan-definisi-operasional-variable2.pdf> [online] 02 Mei 2017.
- [17] Sinaga, Tuti Sarma. (2010). *Manajemen Teknologi*. <https://tutisarmasinaga.wordpress.com/> [online], 30 April 2017.
- [18] Sugiyono. (2011). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D)*. Bandung : Alfabeta.
- [19] Suryana. (2010). *Metodologi Penelitian ; Model Praktis Penelitian Kuantitatif dan Kualitatif*. Buku Ajar Perkuliahan. Universitas Pendidikan Indonesia
- [20] Sutopo, Ariesto Hadi & Arief, Adrianus. (2010). *Terampil Mengolah Data Kualitatif dengan NVIVO*. Jakarta : Prenada Media Group. <http://www.pengertianpakar.com/2015/05/teknik-pengumpulan-dan-analisis-data-kualitatif.html> [online], 02 Mei 2017.
- [21] US Department of health and human services. (1999). *Toxicological Profile For n-Hexane*. Atlanta. Georgia.
- [22] Wanridz. (2015). *Teknologi Berasal Dari Bahasa Yunani* <http://dokumen.tips/documents/teknologi-berasal-dari-bahasa-yunani.html>. [online] 30 April 2017.

THE APPLICATION OF COST-SIGNIFICANT MODEL ON THE ESTIMATED COST OF RESIDENTIAL PROJECT IN SURABAYA, GRESIK, AND SIDOARJO

¹AHMAD FAZA AZMI, ²MIFTAHUL HUDA

¹Civil Engineering Department, Faculty of Engineering, University of Bhayangkara Surabaya

²Civil Engineering Department, Faculty of Engineering, University of WijayaKusuma Surabaya

Surabaya, Indonesia

e-mail: ¹faza@ubhara.ac.id, ²huda.uwks@gmail.com

ABSTRACT

In the early stages of housing project planning, the project owner requires an initial cost estimate as an estimate in determining the value of the investment. For that we need to develop a cost estimation model that is more precise, easy to use, and can be justified. Cost Significant Model is one method of estimating the cost of projects that have been widely applied with fairly accurate results according to some previous research. This study aims to develop estimation model in the early stages of housing project planning in Surabaya, Gresik and Sidoarjo. The development method uses the principle of "Cost Significant Model" and multiple linear regression equation. The data were taken from 8 simple housing project packages using Bill of Quantity method from fiscal year 2012 until 2016 then compared with 1 work package to be implemented. The results concluded that the cost significant item of 85, 78% consists of work: roof and ceiling (X6), painting (X8), sanitation and channel (X11). Cost estimation model of housing development using cost significant model obtained equation $Y = 1,782,020.22 + 0.893 X6 + 4.479 X8 + 4.675 X11$

Keywords: cost, estimate, significant, model, hosing.

1. INTRODUCTION

The growth of the property market is expected to be followed by rising house prices, where the rise in prices is inseparable from rising prices of construction materials and inflation factors. For every residential project developer requires a precise and accurate estimate of price estimates, related to early marketing before the project is completed [1]. Therefore, inaccurate estimation of costs can lead to project efficiency being disrupted which in turn is the main cause of losses and less than optimal results, even the construction project cycle can be cut off [2]. One important process in the project is the cost estimation phase. Often, when the project is in its early stages, the information to estimate is not too detailed, so estimation results tend to be less accurate. Therefore, a cost estimation model is needed that can explain most projects based on as little information as possible. One method of estimation that can be used is the Cost Significant Model, which is an estimation model that uses the cost of work that significantly affects the total project cost [3],[4],[5]

The Cost Significant Model is a model of total cost forecasting of a construction project based on contractor bidding data that has been implemented, which focuses on the most significant job prices affecting the total project cost as the basis for forecasting which is translated into multiple regression [6]. To estimate the cost of the concept of the Cost Significant Model is to rely on well-documented findings, that 80% of the total project cost is contained in the most expensive 20% of work items. For projects that have similar characteristics, the cost-significant items are roughly the same [7].

This study uses data from similar projects that have been implemented previously. This study uses Cost Significant Model method to estimate the total cost of simple and healthy residential development projects in Surabaya and its surrounding areas. The data is collected by using sampling method that is sourced from several developers and contractors in Surabaya, Gresik and Sidoarjo from 2012 until 2016. The purpose of this research is to

get estimation of housing cost to be used by investor and developer in determine the initial of residential project cost estimate.

2. METHODOLOGY

2.1 Research design

The design of this study begins with the collection of bill of quantity project data then the data grouped on each more specific functions. To obtain a more accurate conceptual cost estimation model, this research will develop by Cost-Significant Model estimation method. As the basis of the Cost Significant Model in this study is to group the percentage of mean results on each independent variable to 80% percent of the total value of the highest project then ranked.

2.2 Data Collection

Sampling should produce accurate and precise samples. Inaccurate samples will give unexpected research conclusions or result in false conclusions [8] In this study, data collection is done by reference as follows:

1. Data collected in the form of bill of quantity residential project.
2. Component price of bill of quantities collected without value added tax

2.3 Identification of variables

Identification of variables of this study uses the cost of several jobs as independent variables consisting of: preparation work (X1), foundation work (X2), reinforced concrete work (X3), couple and stitching work (X4), floor work (X5), roof and ceiling work (X6), doors and windows work (X7), painting work (X8), locks and hangers work (X9), electricity work (X10), sanitation and drainage work. Meanwhile, the dependent variable (Y) is the total cost of the project.

2.4 Analysis Method

For the implementation of data analysis techniques, initially the data are grouped, then After the results are grouped data analysis techniques in this study carried out with the following stages:

1. Calculation of influence time value

The influence of time value can be calculated because of the reduced value of money due to the factor of inflation each year. The calculation uses Future Value (FV) with the following equation [9]

$$F = (P + i)^n$$

Where:

- F : The Future value
- P : The Present value
- I : Inflation factor
- n : Year of projection

2. Determine the cost-significant items

By looking at the description of research results, obtained the proportion of each cost component (independent variable) to the total cost (dependent variable). The proportions are sorted from the largest to the smallest. Significant items are identified as the largest items whose percentage is equal to or greater than 80% of the total cost. The independent variables identified as cost-significant items will then be analyzed using the SPSS program [7].

3. Test requirements for analysis

Normality test aims to determine whether the data obtained is Normal distribution or not. The statistical method for testing normality in this study is Shapiro Wilk [$sn_2(x) - Sn_2(x)$], $D = \max$ ". [10]

4. Multiple linear regression analysis test.

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + \dots + a_nX_n$$

Where:

- Y = estimate for the dependent variable Y,
- a_0 = estimated parameter constant a_0 ,
- $a_1, a_2, a_3, \dots, a_n$ = estimated parameter of regression coefficient $a_1, a_2, a_3, \dots, a_n$,
- $X_1, X_2, X_3, \dots, X_n$ = the value of the independent variable.

3. RESULTS

3.1 Research Data

Research data in the form of budget development cost of some residential projects obtained from various source developer and contractor in Surabaya, Sidoarjo and Gresik from 2012 until 2016 can be seen in Table 1. While data of inflation value from 2012 until 2017 in Surabaya city according to sources from the Indonesian Statistics (2017) [12], can be seen in Table 2

Table 1 Residential Project in Surabaya City 2012-2016

No	Name of Residential	Location of City	Sample Housing	Year	Type	Building Area	Total Cost (Rp)
1	Golden City	Gresik	R ₁	2012	40	40 m2	91.000.000,-
2	MentariBumi Sejahtera	Sidoarjo	R ₂	2012	45	45 m2	101.500.000,-
3	Istana Mentari	Sidoarjo	R ₃	2013	40	40 m2	105.000.000,-
4	Mutiara Land	Gresik	R ₄	2014	40	40 m2	110.000.000,-
5	Taman Anggun Sejahtera 5	Surabaya	R ₅	2014	36	36 m2	103,500,000.-
6	SipoaCitylink	Surabaya	R ₆	2015	35	35 m2	102,000,000.-
7	Bukit SekarAnom	Gresik	R ₇	2016	30	30 m2	95,000,000.-
8	The Sun Garden	Sidoarjo	R ₈	2016	45	45 m2	145,000,000.-

Source: Secondary data (2017)

Table 2. Inflation Data of Surabaya City 2012-2016

No	Tahun	Inflasi
1	2012	1,26
2	2013	2,67
3	2014	2,23
4	2015	0,94
5	2016	2,64

Sumber: Indonesian Statistics, Surabaya City (BPS)[12]

Based on Table 1 above and on the basis of data supporting the cost plan of each type of work for each type of house, the sample research data can be recorded as in Table 3. In Table 3 Each independent variable and its value from 2012 to 2016 is grouped from X₁ Up to X₁₁. Similarly, the value of the dependent variable (Y) from 2012 to 2016 can be seen in Table 3

Table 3 Recapitulation of Research Data Sample

Var	Work Item	Budget Cost of Housing, Years				
		2012	2013	2014	2015	2016
		R ₁ + R ₂	R ₃	R ₄ + R ₅	R ₆	R ₇ + R ₈
X ₁	Preparation	2,193,038	2,310,000	2,562,000	2,244,000	5,280,000
X ₂	Foundation	7,992,405	4,620,000	8,753,500	4,488,000	10,560,000
X ₃	reinforced concrete	19,688,608	11,760,000	19,855,500	11,424,000	26,880,000
X ₄	couple and stitching	42,138,006	20,685,000	44,835,000	20,094,000	47,280,000
X ₅	Floor	7,753,608	4,410,000	11,102,000	4,284,000	10,080,000
X ₆	roof and ceiling	48,951,044	24,675,000	58,926,000	23,970,000	56,400,000
X ₇	doors and windows	25,049,367	14,070,000	26,047,000	13,668,000	32,160,000
X ₈	Painting	15,619,304	9,975,000	19,428,500	9,690,000	22,800,000
X ₉	locks and hangers	492,215	1,575,000	427,000	1,530,000	3,600,000
X ₁₀	Electricity	5,755,506	2,730,000	5,764,500	2,652,000	6,240,000
X ₁₁	sanitation and drainage	16,862,025	8,190,000	15,799,000	7,956,000	18,720,000
	Total (Y)	192,500,000	105,000,000	213,500,000	102,000,000	240,000,000

Source: Secondary data (2017)

3.2 Calculation of influence time value

The calculation of the influence of time value of each variable can be calculated by calculating the index of each square meter price of each variable multiplied by the inflation value in 2013, 2014, 2015 and 2016 (see Table 2). Completely calculate the influence of time value on the unit price index of perimeter square work can be seen in Table 4

Table 4. Conversion of Price Index per m2 Against Inflation Rate

SAMPLE	R ₁ + R ₂	R ₃	R ₄ + R ₅	R ₆	R ₇ + R ₈
YEAR	2012	2013	2014	2015	2016
AREA (m2)	85	40	76	35	75
DEPENDENT VARIABLE					
Y	2,324,494.1	2,694,300.0	2,883,373.7	2,991,222.9	3,284,480.0
INDEPENDENT VARIABLES (X)					
X ₁	26,481.6	59,274.6	34,600.5	65,806.9	72,258.6
X ₂	96,510.6	118,549.2	118,218.3	131,613.8	144,517.1
X ₃	237,745.7	301,761.6	268,153.8	335,017.0	367,861.8
X ₄	508,828.8	530,777.1	605,508.5	589,270.9	647,042.6
X ₅	93,627.1	113,160.6	149,935.4	125,631.4	137,948.2
X ₆	591,098.3	633,160.5	795,811.1	702,937.4	771,852.8
X ₇	302,478.5	361,036.2	351,771.6	400,823.9	440,120.3
X ₈	188,607.7	255,958.5	262,387.0	284,166.2	312,025.6
X ₉	5,943.6	40,414.5	5,766.7	44,868.3	49,267.2
X ₁₀	69,499.4	70,051.8	77,851.1	77,771.8	85,396.5
X ₁₁	203,613.9	210,155.4	213,369.7	233,315.4	256,189.4

Source: Recapitulation of Research Data Sample

The variable price of Y and variable X during 2012 to 2016 is calculated average and standard deviation. The proportion of the components of each variable Y, X₁ through X₁₁ can be seen in Table 5.

Table 5. Proportion of Cost Components

No	Variable Description	Symbol	MEAN	SD	%
1	Total Cost	Y	2,835,574.1	2,681,281.5	100.00
2	Preparation	X ₁	51,684.4	46,527.7	1.82
3	Foundation	X ₂	121,881.8	114,366.3	4.30
4	reinforced concrete	X ₃	302,108.0	289,471.1	10.65
5	couple and stitching	X ₄	576,285.6	565,066.2	20.32
6	Floor	X ₅	124,060.5	115,478.0	4.38
7	roof and ceiling	X ₆	698,972.0	678,666.9	24.65
8	doors and windows	X ₇	371,246.1	354,514.5	13.09
9	Painting	X ₈	260,629.0	234,454.1	9.19
10	locks and hangers	X ₉	29,252.1	27,530.2	1.03
11	Electricity	X ₁₀	76,114.1	76,065.1	2.68
12	sanitation and drainage	X ₁₁	223,328.8	225,067.1	7.88

Source: Statistical Analysis Results

3.3 Determine cost significant items

From Table 5 Description of Research Results of Proportion of Cost Components, can be determined cost-significant items as shown in Table 6.

Table 6. Cost Significant Item

No	Variable Description	Symbol	Mean (%)	Cumulative (%)
1	roof and ceiling	X ₆	24.650	24.65
2	couple and stitching	X ₄	20.320	44.97
3	doors and windows	X ₇	13.090	58.06
4	reinforced concrete	X ₃	10.650	68.71
5	Painting	X ₈	9.190	77.90
6	sanitation and drainage	X ₁₁	7.880	85.78

Source: Statistical Analysis Results

3.4 Normality Test

Since the number of samples is less than or equal to 50 then the data normality test using Shapiro Wilk method. Testing is conducted based on the guidance of comparison of probability value with significance value ($\alpha = 0,05$). The data requirement is called normal if probability or $p > 0,05$ or ($p > \alpha$). The summary of normality test results based on Shapiro Wilk value can be seen in Table 7.

Table 7. Normality test based on Shapiro Wilk value

No	Variable Description	Symbol	Probability (sig)	Taraf (sig)	Remarks
1	roof and ceiling	X ₆	0,700	0,05	Normal
2	couple and stitching	X ₄	0,312	0,05	Normal
3	doors and windows	X ₇	0,125	0,05	Normal
4	reinforced concrete	X ₃	0,634	0,05	Normal
5	Painting	X ₈	0,154	0,05	Normal
6	sanitation and drainage	X ₁₁	0,276	0,05	Normal
	Total Cost	Y	0,715	0,05	Normal

Source: Results of SPSS Analysis

3.5 Multiple linier regression analysis test

The results of multiple linear regression analysis can be seen in Table 8. From Table 8 coefficients, the significance value states that; roof and ceiling work (X₆) = 0,000 < 0.05, painting (X₈) = 0,000 < 0.05 and sanitation work and drainage (X₁₁) = 0,000 < 0.05, meaning those works have a significant effect on cost (Y) at 95% confidence level. B constant value = Rp 1,782,020.22 states that if roof and ceiling work (X₆), painting work (X₈) and sanitation and drainage work (X₁₁) are ignored, the cost of house construction per m² is Rp 1,782,020.22. Value B = Rp 1.782., 20.22 states that each additional house expansion cost per m² will increase Rp 1,782,020.22.

Table 8. Constants and Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1,782,020.22	6.953		-.176	.889
roof and ceiling(X ₆)	0.893	.000	.219	105067.215	.000
Painting (X ₈)	4.479	.000	.576	174345.697	.000
sanitation and drainage (X ₁₁)	4.675	.000	.281	104026.185	.000

Dependent Variable: Total Cost; Source : Results of SPSS Analysis

Based on the value of B constant and coefficient values (X₆), (X₈) and (X₁₁) in Table 8, a linear regression equation (model) can be made:

$$Y = 1,782,020.22 + 0.893 X_6 + 4.479 X_8 + 4.675 X_{11}$$

Where:

Y = The cost of building a simple and healthy house (Rp / m²).

X₆ = roof and ceiling (Rp / m²).

X₈ = painting (Rp / m²).

X₁₁ = sanitation and drainage (Rp / m²).

4. CONCLUSION

4.1 Conclusions

1. Roof and ceiling work, painting and sanitation and drainage have a significant effect of 85.78% on the cost of building a simple and healthy house in Surabaya and surrounding areas, while the remaining 14.22% is influenced by other causes.
2. Model cost estimation of development with "Cost Significant Model" is:

$$Y = 1,782,020.22 + 0.893 X_6 + 4.479 X_8 + 4.675 X_{11}$$

4.2 Recommendations

In order to do further research with the object of research with the number of samples more, to improve the modeling results. In addition, future research should be conducted within a wider range of other areas to be more general.

5. REFERENCES

- [1] Falahis, V.D. Sugiyarto. Laksito, B (2015). *Cost Significant Model Sebagai Dasar Pemodelan Estimasi Biaya Konstruksi Jembatan Beton Bertulang*. e-Jurnal Matrik Teknik Sipil. Desember 2015. pp. 957-964
- [2] Soemardi, B. W. dan Reni G. Kusumawardani, (2010) *Studi Praktek Estimasi Biaya Tidak Langsung Pada Proyek Konstruksi*, Konferensi Nasional TeknikSipil 4, 2010
- [3] Kaming, P. F. Ervianto, W.I. Kushartini, (2009). *Pengembangan Cost Significant Model Untuk Estimasi Biaya Proyek Pengairan*. Konferensi Nasional Teknik Sipil 3 (KoNTekS 3), Universitas Atmajaya. Jakarta
- [4] Dewita, R. Putera, Adnyana, I.G.A. Supara, I.G.P (2013). *Model Biaya Pemeliharaan Fasilitas Pada Bandar Udara Ngurah Rai Bali*. Jurnal Spektran. Vol.1, No.2, pp. 7-15
- [5] Akhsa, E. Azmeri. Hafnidar. (2015). *Model Estimasi Biaya Pekerjaan Rehabilitasi dan Peningkatan Jaringan Irigasi Menggunakan "Cost Significant Model"* (Studi Kasus : Dinas Pengairan Kabupaten Aceh Tenggara. Jurnal Teknik Sipil Pasca Sarjana Universitas Syiah Kuala. Vol.4, No.4, pp.83-93.
- [6] Indrawan, Gede Sony. (2011). *Estimasi Biaya Pemeliharaan Jalan Dengan Cost Significant Model Studi Kasus Pemeliharaan Jalan Kabupaten Di Kabupaten Jembrana*. Tesis (S-2): Teknik Sipil Universitas Udayana. Denpasar
- [7] Fikri, R.M Sekarsari, J. (2015). Analisis Estimasi Biaya Proyek Peningkatan Jalan beton di Kabupaten Tangerang Dengan Metode Cost Significant Model.Seminar Nasional Teknik Sipil Tahun 2015-UMS. Solo
- [8] Handayani, F.S. Sugiyarto. Panuwun, R.T. (2015). *Komponen Biaya yang Mempengaruhi Estimasi Biaya Peningkatan Jalan Provinsi*. e-Jurnal MatrikTeknikSipil. September 2015. pp. 903-907.
- [9] Aptiyasa, P. A. A (2016). *Cost Model Konseptual Untuk Bangunan Gedung Rumah Sakit*. Tesis Magister Teknik Sipil (S-2), Program Pasca Sarjana Universitas Atmajaya Yogyakarta.
- [10] Ghozali, I (2011) "*Analisis Multivariate Program SPSS 19*" :Badan Penerbit Universitas Diponegoro Semarang
- [11] Bakar, A. (2014). *Estimasi Biaya Dengan Menggunakan Cost Significant Model Pada Pekerjaan Jembatan Rangka Baja di Proyek Pembangunan Jalan Lintas Selatan Provinsi Jawa Timur*. Jurnal Teknik Sipil Untag Surabaya 1. Vol.7, No. 1, pp. 1-10
- [12] BPS. (2017) *Data Inflasi Kota Surabaya*. Diakses pada <http://klatenkab.go.id/web/content/daftarrumah> Pada tanggal 25 Mei 2017, Pkl 09.00WIB

CONTROL SYSTEM AND MONITORING OF SOLAR CELL LIGHTING BASED ON ANDROID USING ARDUINO UNO

¹ AHMADI,²KUSPIJANI ,³PRIHASTONO

^{1,2,3}Prodi Teknik Elektro Universitas Bhayangkara Surabaya

¹ahmadi@ubhara.ac.id,²kuspijani@ubhara.ac.id ,³prihastono@ubhara.ac.id

ABSTRACT

Increased global energy demand resulted in an energy crisis. Solar Cell is one alternative to fossil energy because it can convert solar energy into electrical energy. In this study aims to use energy from solar cell battery as a replacement for PLN energy.

In this Final Project, an equipment control apparatus will be generated from the solar cell battery voltage through the wifi network, where application users do not necessarily have to go to the switch box to turn on the equipment, but only by pressing the button on the android to activate the equipment desired.

1. Introduction

The development of various electronic devices around us already have the ability of wireless computing and communications, for example; TV, VCD, air conditioner. To illuminate a number of rooms and home pages of course we need a lot of lights so by itself must have many different outlets (as control devices) that are located differently. Therefore for the convenience of user device that I will make this must be able to interact with user without complicated configuration. Standard Remote control uses Infra Red (IR), while new technology uses radio waves, one example is Wifi.

Technology has several advantages over IR. The main advantage of wifi over IR is that Wifi devices do not have to be in line of sight, so devices can interact with each other in spite of obstacles. For that, by utilizing existing technology on android-based phones, the authors here want to develop methods of controlling and monitoring Solar Cell Lights using Wifi found on Android-based smartphones on the application of technology that will be designed authors.

This application can be an alternative to control and monitoring of Solar Cell Lamps where the old controller is a switch connected with the cable and cannot monitor the state of the lights on or off, this will be replaced by utilizing Wifi on Android-based phones, so it can control and Monitor lights.

2. System Design

3.1 Control System

In this system, the user inputs from the existing lamp control app on the Android device. The input used is a standard input that is switch button. The data entered is serial data sent to Arduino via Wifi. Data sent from Android will be received by the wifi module in the microcontroller system. Where in this case the microcontroller is Arduino. The serial data is translated by microcontroller into parallel data. Parallel data generated by

Microcontroller forwarded relay through LED indicator that serves to ascertain whether there is wrong pairs or not. If up to this stage the process runs smoothly, then relay will forward the data used for

Turn on and off the lights. Led indicator functions as feedback. That is when the lamp is alive, led will also live. Vice versa. The led conditions on / off are used as inputs to the Arduino. Data obtained from the Arduino is sent back to the Android device.

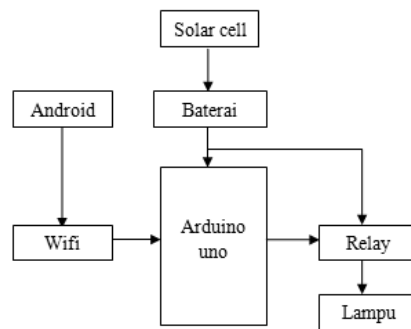


Fig 3.1 Block diagram control system

In the above block diagram, the solar cell is the input voltage to charge a battery used to power the arduino and DC lamps connected using the module relay.

Arduino as a data processor sent by android via Wifi module.

3.1.1 Arduino Program

This program functions as a recipient of data sent from an Android device. Here is the program list:

```
wifi Arduino 1.6.9
File Edit Sketch Tools Help
wifi
#include <SoftwareSerial.h>
#define DEBOD true
SoftwareSerial wifi(2,3) // RX, TX

void setup() {
  Serial.begin(9600);
  wifi.begin(9600);

  pinMode(10, OUTPUT);
  digitalWrite(10, HIGH);
  pinMode(11, OUTPUT);
  digitalWrite(11, HIGH);

  // Reset modul
  sendCommand("AT+RST\r\n", 2000, DEBOD);
  // Konfigurasi sebagai Akses point
  sendCommand("AT+DMODE=3\r\n", 1000, DEBOD);
}

Done uploading
arduino:done. Thank you.
```

Fig 3.2 Arduino Program

Once the arduino program for the control has been uploaded, then assemble arduino, wifi module and relay module to be able to control the light via wifi and android as in figure 3.3.

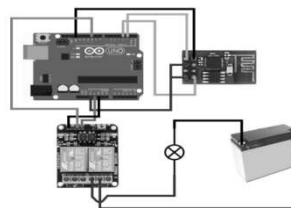


Fig 3.3 Control system circuit

3.2 Monitoring Design

Material Monitoring

- Voltage Sensor

The voltage sensor here as the incoming voltage detector at the lamp is then processed by the arduino microcontroller and displayed on the lcd.

- Current Sensor

The current sensor as a current detector that flows on the lamp into, is then processed by an arduino microcontroller and displayed on the lcd.

- Microcontroller

Microcontroller used is the type of arduino UNO which in charge of receiving data with all the advantages such as analog data receiver etc, which later data can be accessed via computer. But the arduino itself must first be programmed according to the need.

- LCD

As the output of data that has been processed in microcontroller can be displayed various ways, one of which is the use of LCD. This LCD is required for users who want to see the measured energy quantity does not have to always look at the monitor or computer, simply by looking at the LCD display.

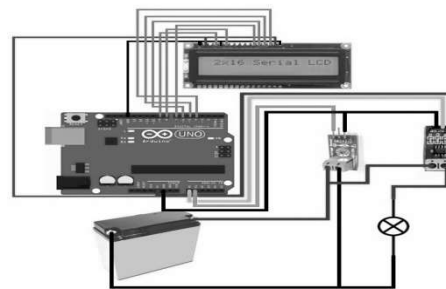


Fig 3.4 Monitoring circuit

3. Testing

To know whether the work or not the device that has been made either hardware or software must be done a test in the form of performance as well as with measurement of the device also to the response generated. A system is said to work well if the system works in accordance with the initial goal achieved when first done the design.

From this test will be obtained data that contains the advantages or disadvantages of the components or sensors and systems used. With this test it is expected that the weaknesses of the system can appear and be improved in order to obtain better results through corrections to the weaknesses encountered during the test.

4.1 Testing Mini Solar cell

Mini solar cell functions to convert solar heat into DC volt voltage, the maximum voltage generated by mini solar cell reaches 6 VDC only. However, the voltage can be increased by using step up-down boost buck converter.



Fig 4.1 Step up-down boost buck converter.

Thus we can increase / decrease the voltage according to our wishes.



Fig 4.2 Testing of solar cell voltage

Table 4.1 Testing of solar cell voltage

Time (Clock)	V out from Solar Cell (Volt)	V out from step up converter (Volt)
12:10	5.3	12.26
12:15	5.1	11.79
12:20	4.7	10.87
12:25	4.7	10.87
12:30	4.9	11.33
12:35	4.6	10.63
12:40	5.1	11.79
12:45	5.2	12.02
12:50	4.9	11.33
12:55	4.8	11.1
13:00	5.6	12.95

4.2 Current and Voltage Sensor Testing

This test aims to determine the function of equipment on electronic equipment and the functioning or not the equipment.



Fig 4.3 Testing voltage and current sensors with no load



Fig 4.4 Testing voltage and current sensors with load

4.3 Testing Controller Applications

This test aims to determine the function of control devices on / off on electronic equipment and the distance of control activation lamp using android phone.



Fig 4.5 Testing the controller app before the button is pressed

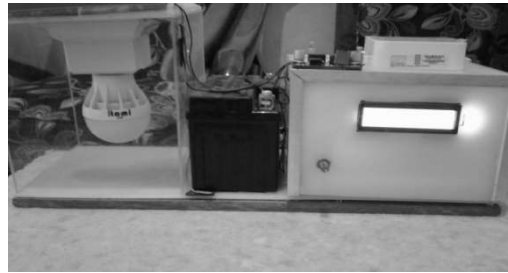


Fig 4.6 Light off



Fig 4.7 Testing controller app after button is pressed



Fig 4.8 Light on

The test results from designing prototype solar cell light control system using arduino based Android phone is as follows:

Table 4.2 Results of testing wifi controls

No	Range Distance	Time	Without Barrier	With Barrier
1	1 Meters	5 second	ON	ON
2	5 Meters	5 second	ON	ON
3	10 Meters	5 second	ON	ON
4	15 Meters	5 second	ON	ON
5	20 Meters	5 second	ON	ON
6	25 Meters	5 second	ON	ON
7	30 Meters	5 second	ON	ON
8	35 Meters	5 second	ON	ON
9	40 Meters	5 second	ON	ON
10	45 Meters	5 second	ON	ON
11	50 Meters	5 second	ON	OFF
12	55 Meters	5 second	ON	OFF
13	60 Meters	5 second	ON	OFF
14	65 Meters	-	OFF	OFF

4.4 Advantages and disadvantages

4. Conclusion

Based on explanations and experiments, we can illustrate the advantages and disadvantages of the lighting control system as follows.

1. Advantages

- Time and energy efficiency.
- Practical to use.
- Users can control this electronic device within a specified range, which is in the table.
- Users can control electronic devices more safely because they do not make direct contact with electrically powered devices.
- Safe for children and people who are afraid of being electrocuted.
- Can be controlled more than one device.

2. Weakness

The range of connections using Wifi is far enough for unobstructed space conditions. However, when crossing a wall or other barrier material, the connection distance will decrease. Or it could be called reduced range effectiveness.

Cost of devices that tend to be expensive compared to switches in general.

Based on the results of the analysis, the results of experiments and tests that have been done on this control system, obtained some conclusions as follows:

- In the manufacture of prototype devices control system and lighting monitoring using Arduino-based Android phone has a main design, namely the mechanical design of the Arduino, wifi module, voltage sensor, current sensor, lcd, relay module, and lighting devices.
- Wifi communications can only be done under limited distance conditions depending on the transmitter signal capture power of the wifi module and the android smartphone.
- This research has produced a simple and user-friendly interface to be easily operated by the user.
- Android has supported the complete features to build a communication system with a microcontroller.

BIBLIOGRAPHY

- [1] Saftari, Firmansyah, 2015 “PROYEK ROBOTIK KEREN DENGAN ARDUINO”. Jakarta: Elex Media Komputindo.
- [2] Warangkiran, Imanuel, 2014. “PERANCANGAN KENDALI LAMPU BERBASIS ANDROID”, Jurnal Teknik Elektro dan komputer, UNSRAT, Manado
- [3] Firdaus, 2014. “MONITORING DAN KENDALI LAMPU BERBASIS JARINGAN WIFI UNTUK MENDUKUNG SMARTHOME”, Jurnal Rekayasa Teknologi Industri dan Informasi. STTNAS, Yogyakarta