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# Implementation of Smarthome System Installation Based On Humanity

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## Abstract

*In the smarthome system, four main designs are used: Lighting settings, and use of air conditioner (AC). Leak detection of LPG and cigarette smoke, in order to provide convenience and comfort for homeowners to control household appliances, besides the energy management system is applied to see how far the energy savings have been done. This research aims to design and create a smarthome system that is integrated with energy management system which is done by calculating efficiency and effectivity of electric energy usage from designed application, and analyzing human integration to smarthome technology in sustainable energy management with ergonomic approach.*

*By calculating the comfort level of the smarthome system integration and energy management in the smart general system of electricity humanity (SGS-EHUM). SGS-EHUM integration between equipment that allows calculation of consumption of electrical energy consumption directly can be done. So hopefully with this research become one of solution of energy problem.*

**Keywords:** Smarthome, Energy Management, Energy Saving, Sensor, Integration, Convenience, Ergonomic

## 1. Introduction

Safety and comfort are important thing for human being. A hundred thing tha human do to create saftey and confort. One of them is home safety. Restless feeling may be caused by the possibility of theft, fire against valuables. If the home is empty, so that it cannot be guarded well. It is different situation if we can know fastly the condition what will happen of our home.

It also for the fire accident, it will be caused by the crowded and stuffed then the shortet or LPG gas explosion. Based on the data of the Public Policy Study Centre (Puskepi), from 2008 till July 2010 had 189 times LPG gas explosion. Where, there were 61 cases on 2008, 50 caseson 2009 and 78 cases on 2010 (Siswanto, 2010). In 2011 till May, there were 59 cases of LPG gas explosion. There were 12 cases on January, 18 cases on February, 11 cases on March was 11 cases, 11 cases on April and 7 cases on Mei. The accidents were dominated on LPG 3 kg users around 83 % (Arifenie, 2011).

Human integration by smartphone system was dominantto determine of safety and comfort for human being now days. The accessibility of smartphone using is determined by human as main control; it is bad, easy, and difficult in access. When open the system or tools so that it is important to know the ergonomic, the ergonomic has a big rule. In ergonomic science, human as main thing in a

system (*Human Integrated Design*), so that the human should be aware that he/she become a key controller in being success of human-product system operationalization. The main concentration of ergonomic is the measurement efficiency based on the speed and the accurately of human performance in using the tools. The worker safety and comfort factors have been mentioned efficiency by Wesley E Woodson.

This concept combined the architecture design, interior design and electrical mechanical in order to give the move speed/ mobility and the accessibility from many side, also it can be used whenever automatically in a building or home without human intervention.

The research problem statements were; How is the correlation between the ergonomictoward the comfortable in doing home activity with integration sensors? , and the second was; Do the implementation of smarthome bring the well effectively and the efficiency at home. The aim of this research was to show the well ergonomic for smart home system application which bring the comfort for the users.

## 2. The review of Literature

### 2.1 The Idea of Ergonomics

Ergonomic defined by Wignjosoebroto (2000) that ergonomic (English) comes from Greek is Ergo means that work and Nomos means that law. So that ergonomics means as discipline which learn the human activities. This ergonomics is popular in West Europe. In America is known as

Engineering Human Factor. There are many definition also for ergonomic practically like biomechanics, biotechnology, Engineering Psychology or Arbltswissensenschaft (Germany). Ergonomic concern specifically learns the limitation and the ability of human in integrated with the technology and their products.

A facility is designed with well ergonomic principle. The space created can accommodate the activity, like human as user of space and its interaction with the tools and facilities around. Beside the functionally, the present designing should bring the safety, healthy, security and the comfort for the user when do the activity (Wardani, 2003).

### 2.2 Definition of Comfort

A comfort concept is very difficult to be defined because it is very individual responsive assessment (Osborne, 1995). Based on the Indonesian Language Dictionary that, comfort is fresh; health. Comfortable is well situation; freshness; coolness (Kolcaba, 2003). There are foreign language interpret that comfortable is relax situation, where there is no sickness for body condition. Need for self-security based on Maslow in E. Koeswara (1986: 120-121) defined that need supports the individual to get tranquility, certainty, and the regularity of the state of environment.

### 2.3 Sensors

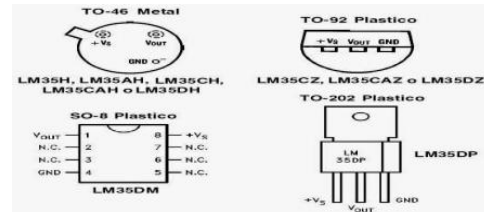
**MQ-2** is electronic components to detect hydrocarbon gas level like isobutene ( $C_4H_{10}$  / *isobutene*), propane ( $C_3H_8$  / *propane*), methane ( $CH_4$  / *methane*), ethanol (*ethanol alcohol*,  $CH_3CH_2OH$ ), hydrogen ( $H_2$  / *hydrogen*), smoke an LPG (*liquid petroleum gas*). This gas sensor can be used to detect the gas leakage at home/ factory, for example to create the electronica design of LPG leakage detection.



Picture 1. Sensor MQ2

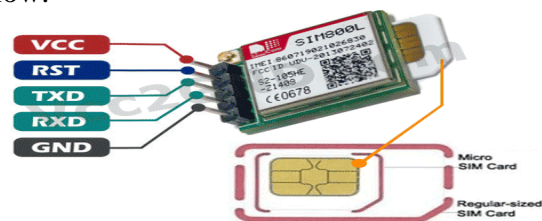
**LM35 temperature sensor is electronica component which has function to change the temperature level become electrical temperature in intensity form. LM35 temperature sensor**

which is used in this research like electronica component which produced by National Semiconductor. LM35 has the high accurate and then easily designing if compare with the other temperature sensor, LM35 has impudence and high linearitesso that it can easily connected with the special controlling circuit. It has not also need the next calibration.



Picture 2. Kinds of form and LM35 structure Modul of GSM-GPRS GSM SIM800L

**Quad-band Network based on the modul of SIM800L** support the quad-band GSM/ GPRS network, there are data transmision in the long distance of GPRS and SMS. The feature board and the low stream consumption are designed by power saving technique, this consumption in the lowest 1mA in the flying mode. This one communicates with microcontroller through UART port, support the instruction include the 3GPP TS 27.007, 27.005 and SIMCOM which is completed on the Commands. The physical form of module can be seen on the picture 3 below.



Picture 3. SIM800L(GSM MODUL)

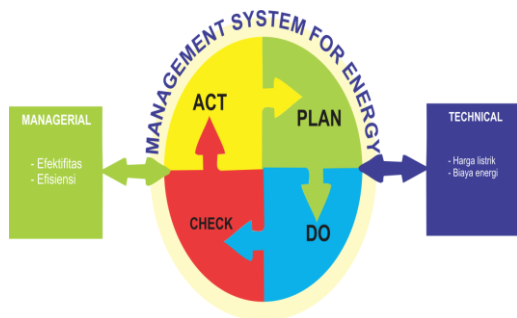
### 2.4 Manajemen Energy

Verein Deutscher Ingenieure provide the definition of energy management as "proactive activity, organized and systematic procurement, conversion, distribution, and the use of energy that meets the needs, taking into account environmental and economic objectives. (Wikipedia)

The purpose of energy management in the industry is :

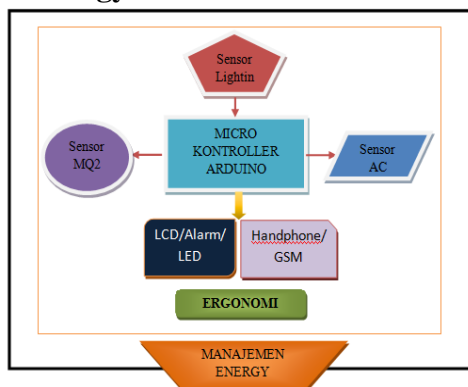
1. Optimizing the utilization of energy and energy resources

2. Increasing the efficiency of energy and energy resources use
3. The use of opportunities to enhance the competitiveness of enterprises



Picture 4. Energy Management System

### 3. Methodology



Picture 5. System of sensors construction scheme on the Smarthome

The theme of this research toward the ergonomic used the qualitative method with case study approach. This research find the important variabel related to the subject which is studied in this case was measurement, circulation, and height of works tools (cabinet, kitchen). The literature study and documentation supporting with the data complication to did this qualitative study. This case study was raised from the dynamic of smart home design development now days while combine the patent ergonomic theory related to the safety standard.

### 4. Results And Discussions

The basic problems of this study were:

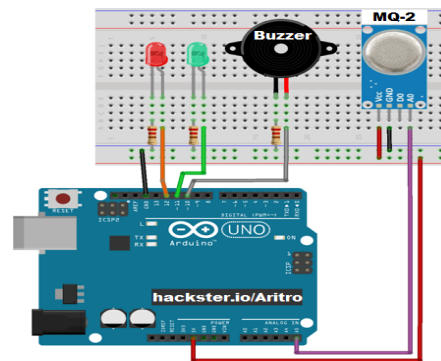
1. The thief happen to the empty home, so that the feeling of safety and anxious.
2. The fire happen caused by the gas use raised the losing of property and also the die.
3. Unwell environment caused by the smoke of the host or the guests.

4. The shine as the source of home energy or the building light in order to feel comfort in doing the activity in or out home.

### The Tools Design

#### MQ2 Sensor of Gas detection/ Arduino

1. ArduinoUno
2. Jumper cable/ connector
3. MQ2 Sensor.
4. Alarm.



Picture 6. MQ2 sensor simulation

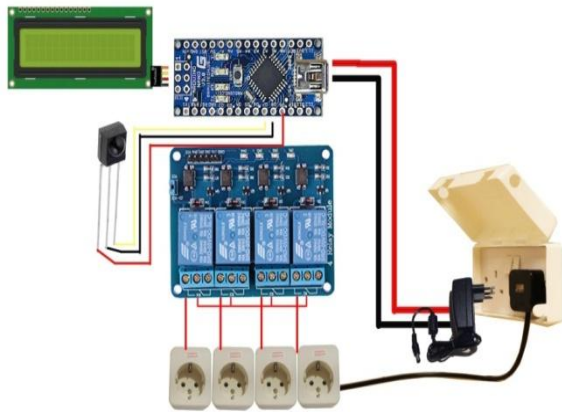
### LPG sensor Gas

LPG gas reading is taken through the LPG (MQ-2) sensor data have analog intensity then changed become 10 bit digital data with 0 value till 1023. From these data will be the first data to do the calibration process which is kept in the AT Mega 16 microcontroller program.

Working system with detection LPG gas level is in the source room/ machine which use the LPG. If there is LPG gas which detected so that the tools will flow the first indicator PPM LPG value toward the LCD and if there is increasing so that the leakage lamp indicator will give light signal based on the level of situation. Next the leakage data will send to the computer through the hyperterminal and if the leakage continuously increase, so that Ex-house Fanto decrease the LPG level in the room and if the LPG gas level increase continuously and get the fluid border/ fire, so that the system will turn off the electrical source in the room also the Exhouse Fan and will turn on the Alarm.

**Light Dependent Resistor (LDR)** is kinds of resistor which the value of obstacle influenced by the light around. So that we can create this LDR become light sensor, because it has been more of its application. For example on the

streetlight there is no sacral to turn off and to turn on it



**Picture 8. Tools Design Block**

**The ergonomic outflow can bring the safety and comfort feeling for human**

One of the designing has well criteria if it can fulfill the concept of *E.N.A.S.E* (Efektif, Comfort, Save, Health and Efisien). In ergonomic science human as a core of this system (*Human Integrated Design*), so that should be well realize that human factor become a key to success in system operationalization of human-machine (product); it doesn't matter that the system still manually, *semiautomatics* (mecanic) or full-automatics.

In the ergonomic research become a lot of parts like:

#### 4.1 Display research

The application of ergonomic generally is design of activity or redesign. One of the human limitation factors become the first eye as the limitation body dimension.

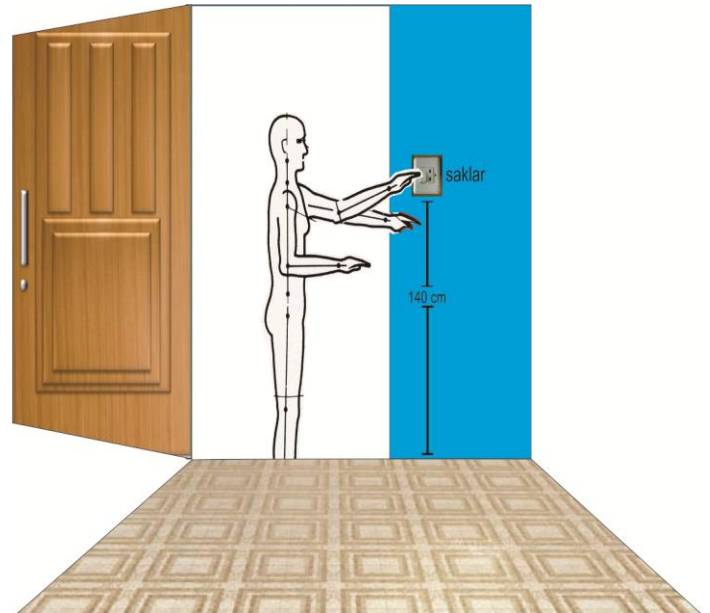
##### 1. Ergonomic in the lighting

A frequent complaint:

1. The point of sacral/ stop contact in home which has distance to the main door raised the unwell on the night when he/she arrived, difficult to find the stop contact/ sacral.
2. The lighting in home like to do the habit such as reading, writing, looking around and etc. can be made the general lightings

##### 2. The way to over the complaint

- The tool of lay out is used to ergonomic home.



**Picture 9. The layout of ergonomic Stop contact**

The point of well stop contact is pointed in the right highest. Dainof is placed in the right side from the main door, so that when the host (she/he) arrives at home will turn on easily of the living room.

##### 3. The lighting sensor

It focused to the lighting in the lay out display. It's aimed to avoid the eye fatigue.

There are some important to be pointed that:

1. Avoid to the user from the direct bright light/indirect
2. Manage the balance between the brightness layout and the brightness in front of user.
3. Avoid the dazzling light, direct/ indirect, which refers to the display.
4. Check accurately that the light enough for the working which does not need of display.

##### 4. The Temperature and the Air

The air comfort (thermal comfort) is the condition where human beings do not feel too hot or cool when she/he only uses casual. This air comfort can be gotten with the humidity, temperature, and air flow setting.

The air comfort measurement (ASHRAE Standard 55)

1. The air flow speed : 0.15 m/s.
2. The temperature in winter : 23 - 26 C.
3. The temperature in summer : 20 - 23.5 C.



**Picture 10. Ergonomic air conditioner (AC) discharge design**

### 5. Safety aspect and comfort from LPG

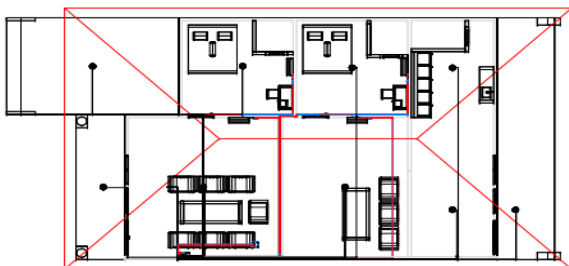
The main thing of ergonomics is to create the comfort, safety, and productivities in doing work. The work safeties in the kitchen like area or cabinet for keeping of the sharp thing and the fragile objects have to be differing and keep away. The other main thing is for the safety toward the cooking area which available becomes a fluid of LPG. So that the cylinder keeping have to be close the gas stove and enough airways.



**Picture 11. LPG Gas which ergonomic putting**

### 4.2 Calculation of Energy Consumption

Electrical energy is the electricity used in a certain period of time. The amount of electrical energy used in an electrical equipment is proportional to the voltage (V) and strong electric current (I) against time (t).



**Picture 12. Smarthome Plan**

Source : Personal

Mathematically can be written with equations:

$$E = V.I.t \text{ or } E = P.t$$

Table . Measurement data

Waktu (Menit)	AC 1 (Ruang Tamu)			AC 2 (Ruang Keluarga)			AC 3 (Kamar Utama)			AC 3 (Kamar 2)		
	Teg. (V)	Arus (I)	Energi (kWh)	Teg. (V)	Arus (I)	Energi (kWh)	Teg. (V)	Arus (I)	Energi (kWh)	Teg. (V)	Arus (I)	Energi (kWh)
00-05	219,00	1,168	0,021	219,00	1,169	0,022	-	0,000	0,000	-	0,000	0,000
05-10	221,00	1,153	0,021	221,00	1,154	0,021	-	0,000	0,000	-	0,000	0,000
10-15	219,00	1,156	0,021	219,00	1,155	0,021	-	0,000	0,000	-	0,000	0,000
15-20	221,00	1,154	0,021	221,00	1,156	0,021	-	0,000	0,000	-	0,000	0,000
20-25	219,00	1,148	0,021	219,00	1,149	0,021	-	0,000	0,000	-	0,000	0,000
25-30	221,00	1,159	0,022	221,00	1,158	0,021	-	0,000	0,000	-	0,000	0,000
30-35	218,00	1,169	0,021	218,00	1,169	0,021	218,00	1,167	0,021	218,00	1,168	0,021
35-40	220,00	1,153	0,021	220,00	1,154	0,021	220,00	1,152	0,021	220,00	1,153	0,021
40-45	217,00	1,156	0,021	217,00	1,155	0,021	217,00	1,157	0,021	217,00	1,157	0,021
45-50	220,00	1,154	0,021	220,00	1,156	0,021	220,00	1,155	0,021	220,00	1,155	0,021
50-55	221,00	1,148	0,021	221,00	1,149	0,021	221,00	1,150	0,021	221,00	1,148	0,021
55-60	219,00	1,159	0,021	219,00	1,158	0,021	219,00	1,158	0,021	219,00	1,159	0,021
			0,2558			0,2561			0,1277			0,1278

Source: Primary Data,2017

From the object measured 4 (four) air conditioner (AC), big energy consumption AC (1) amount 0,256 kWh, on AC (2) energy consumption 0,256 kWh, while on 30 first minute AC (3), (4) out there is no energy in use. Konsumsi energy thirty minutes later on AC (3) and AC (4) amount 0,128 kWh. From all measurements AC, energy consumption 0,7675 kWh.

From the table above in the initial 30 minutes, AC (3) and AC (4) does not work. This is arranged according to certain hours only so that the level of electrical energy consumption can be reduced as much as possible.

It also helps people from neglect (forget) turn off the electrical equipment (AC) at certain hours where during these hours there is no activity.

Therefore, the purpose of energy consumption management through austerity efforts can be achieved.

### 5. Conclusion

With a smarthome system designed with an ergonomic approach can provide comfort in doing activities in the house, reducing complaints against the laying of electrical appliances and able to provide a sense of security. With ergonomic and humanity safe home conditions, comfortable, healthy, and efficient (savings) can be achieved

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