# THE SOCIALIZATION OF SMART BUILDING IMPLEMENTATION IN LIGHTING SYSTEM

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***ABSTRACT***

Smart building is an application of an automatic control system to a building. Where this system has been arranged using a neatly structured algorithm. Almost all parts or building components can be managed automatically. Therefore, it can also be called a Building Automation System or BAS. The working principle of this smart building is the integration of various components in the building. From these installed components, apart from being able to be set automatically, there is also communication between components. In general, the method used for smart buildings is to use sensors. The larger the building, of course, the higher the energy required. If the property management still manages it manually, there is a tendency for a factor to be missed This makes energy use more wasteful. In addition to lighting and HVAC, many components of buildings use electricity. Such as pumps, dispensers, computers, televisions, and so on. It should be off or not connected to electricity when the building is empty.

**Keyword** : Smart Building, Elektricity, Automatic Control

## *1.INTRODUCTION*

The development of the times followed by technological advances, the need for convenience in a residence with the support of automatic technology is increasing. This automatic technology provides convenience for building occupants/users and can minimize energy use properly. From the problems above, the electrical engineering study program at Widyatama University held a Smart Building socialization at Pelita Bunga Bangsa Vocational School located in Arjasari, Kec.

Arjasari, Kab. Bandung, West Java, this Smart Building functions to control an electrical device or equipment automatically and efficiently

Smart buildings can reduce the building's electrical power consumption by regulating the use of electrical energy in a balanced manner optimal. This smart building system is predicted to be able to reduce power consumption in a building and be operated automatically. This system can be in the form of a lighting control system in the room, air conditioning system control up to control of a building's security system, all of which are directly connected to a system that makes it more organized when compared to manual system work. With Smart Building, it can be arranged, controlled and monitored easily, quickly, effectively, economically and efficiently.

Smart building is a building with the use of high-level modern technology such as using PLC (programmable logic controllers) which are then connected to several other components such as sensors, controls, and actuators to control almost all parts of the building[1]. Sensors in smart buildings are used to remotely sense various conditions in the building. Various kinds of sensors such as light sensors, temperature sensors, motion sensors, pressure sensors, and others can be used

Controls in smart buildings are used to monitor and control buildings where control can be in the form of a microcontroller or computer. Meanwhile, actuators in smart buildings are used to drive various systems in the building as output from sensor sensing. Actuators that can be used include motors for automatic doors, water pumps, buzzers for fire alarms, and many more[1, 2].

In addition to reducing electrical energy consumption and reducing human error, smart building can also make it easier for humans to meet their needs because it prioritizes automation in the system. The smart building design also prioritizes the aesthetics of the building itself. However, in addition to the advantages offered, this design also has disadvantages such as the initial cost of construction which is quite high.

In developed countries, the market for smart building technology is expected to grow 34% per year over the next five years, according to a recent report on how the interest in developing smart cities and internet things is.

In 2017, electricity consumption increased by 2.5% [3]. One of the things that makes energy consumption continue to increase is the human error itself, such as forgetting to turn off the room lights when the room is not in use, leaving the TV on all day, and much more. A smart home control system allows homeowners to control electronic equipment at home with using voice commands. Digital sound processing can be developed. to make human life easier[4]. In this case the human voice can be processed to be converted to be understood by a respondent so that the spoken command can be responded to by the controlled device. Digital voice processing is controlled by an application to recognize the presence of a detected voice command, which is often called voice recognition.[5] Voice recognition technology works by capturing human voices which are converted into digital format and translated in a system. The system will then compare the input information which is already in digital format with the existing sound database.

This research contributes to making a prototype of an electronic equipment control system through bluetooth media using voice recognition[6]. The system in question can control electronic equipment wirelessly with a smartphone. Wireless control is done via Bluetooth with a special application on the Android operating system[7]. The application includes a voice recognition feature that allows users to give commands via voice

The increasing need for comfort and convenience of services supported by automatic technology in buildings, causes the need for the development of building services to provide satisfaction to building users[8]

**2.The Limitation of Problem**

The limitation of the research problem is something that is very important in getting closer to the main problem to be discussed

This is so that there is no confusion or confusion in interpreting the research results.The problem limits are as follows :

1. This smart building is implemented in the form of a prototype in the form of a BOX with a size of 15 x 15;

2. Installation of smart buildings for a series of control systems for electrical equipment, lights, radar sensors, LDR and information systems in the form of a 16x2 LCD display;

3.Using the RCWL Radar Sensor as a Motion Detector

4.Arduino Microcontroller Board and controlled using an android smartphone using a Bluetooth device;

5.Using a Bluetooth HCO5 device for connection between Prototype and Android Smartphone

6.Implement knowledge and assist in finding solutions to problems that often occur in society

The purpose of implementing PKM in the Electrical Engineering Study Program S1 is to increase knowledge, especially electrical insight in maintaining the safety of electrical equipment in everyday life. At this implementation stage, counseling and discussion are carried out

In this PKM activity, the team chose a school located in Bandung regency, because it is quite far from the city, which of course in terms of smart homes or smart buildings is something new, this of course has an impact on public knowledge about the safety of electrical equipment with the smart building method. regulatory voice recognition

The stages of this PKM are as follows: Preparation of activities includes

1. Survey activities for community dedikation places, namely at Pelita Bunga Bangsa Vocational School, Arjasari Village, Arjasari District, Bandung Regency

2.Permission for community deducation activities to the Principal of SMK Pelita Bunga Bangsa, Arjasari Village, Arjasari District, Bandung Regency c. Administration (correspondence)

d. Preparation of tools and materials as well as accommodation

3. Socialization activity include :

a.Opening and introduction to the Pelita Bunga Bangsa Vocational School, namely students and teaching staff of Pelita Bunga Bangsa Vocational School, Arjasari Village, Arjasari District, Bandung Regency who were the targets of the activity.

b. Presentation on the topic of Smart Building, the purpose of creating this technology, the impact of damage to electrical equipment in the room if the electrical equipment is not turned off

c. Discussion/question-and-answer session with participants

***3. THEORITICAL BACKGROUND***

***3.1 VOICE***

Audio is a term used to describe the sound that the human ear can hear within a certain distance and is measured using Hertz [Hz] in a device. Digital audio forms, both sound and music, can be stored or played on storage devices such as computers, called audio files or sound files. One of the most popular types of audio file formats today is MP3 .

Audio is divided into two main categories, namely analog audio and digital audio. The following is an explanation: Analog audio is a sound that represents an electric voltage either active or potential that

causes variations in pressure and displacement of the wave medium. This wave creates maximum compression in a few cycles measured in Hertz or cycles per secondWhile converters, called transducers, in analog audio are called microphones [sound into audio], loudspeakers and headphones.

Analog audio can only work on analog audio equipment which can also There are several examples of analog audio, including:

a.Audio that pops up when you talk to other people [*speech*]

- b.Audio that appears due to the sound of the musical instruments being played, whether it's acoustic, to Audio that arises due to sound effects [*sound effect*]. For example, the sound of a car, the sound of a motorbike, the sound of broken glass, the sound of a fan, the sound of an airplane and so on are re-recorded using tape or vinyl to be stored and played later.

Digital audio is audio that represents sound as a series of binary numbers or describes sound wave-based similar to that in analog audio. The difference between analog audio and digital audio is in the waveform, represented by small amplitude samples, which are stacked one after another to produce a representation of the audio signal. Digital audio can be stored on a hard drive, Compact disk [CD], server or anywhere else as long as it supports file storage. digital.

There are several examples of digital audio, including:

Audiovisual which is a sound system equipped with pictures and is widely used for [LCD] presentations, plug-in screens, cinema and TV

- Audio streaming which is an audio term that appears during live broadcasts [**live streaming**] happen. This kind of audio system is different from other types of audio because here the file does not need to be downloaded in order to be heard
- Response audio which is the sound produced by all computer devices. This is the response output from the device in response to user commands. For example, the sound when turning off the CPU on the computer, when typing on the keyboard and so on
- Audio modem riser [AMR]

a plug-in card on an Intel chip motherboard that contains audio circuitry and a modem. This card can produce the analog audio needed for modem operation and can also be converted into computer-readable digital codes.

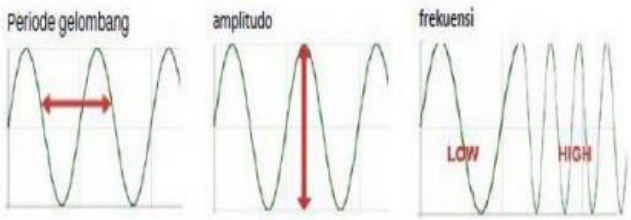


Fig 1. Graphics of Audio Signal (sound waves).

Audio is defined as sound or sound reproduction. Audio signals or sound waves are waves generated from an object that vibrates in the audio frequency range (can be heard by humans). The human ear can hear sounds between 20 Hz to 20 KHz within the limits of the audio signal. Because basically

Audio signals are signals that can be received by the human ear. The number 20 Hz is the lowest sound frequency that can be heard, while 20 KHz is the highest frequency that can be heard

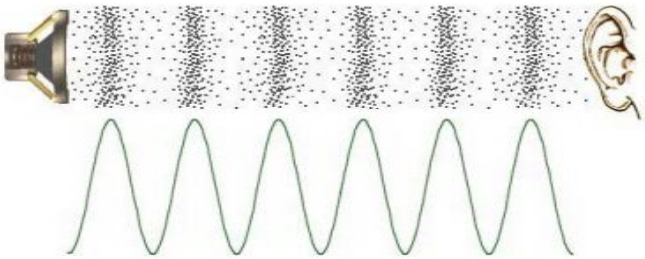

Fig 2. Audio signal propagation

There are four main functions of audio, namely:

a. Help convey information to be clear and precise. For example, the use of background sound in videos, TV and so on

b. Increase the attractiveness of the information conveyed

c Increase the motivation of the audience to be more interested in hearing the information conveyed by someone, directly or indirectly d.Facilitate the communication process that is carried out by someone with the other person

### *3.2 VOICE RECOGNITION*

The human voice can be processed to be converted to be understood by a respondent so that the spoken command can be responded to by the controlled device. Digital voice processing is controlled by an application to recognize the presence of a detected voice command, which is often called voice recognition

Voice recognition is a system to identify a person by recognizing the voice of that person. Voice Recognition or speech or voice recognition (speech recognition) is a technique that allows a computer system to receive input in the form of spoken words. These words are converted into digital signals by converting sound waves into a set of numbers and then adjusted to certain codes and matched against a pattern stored in a device. The results of the identification of spoken words can be displayed in written form or can be read by technological devices.

The software system used is Google Voice and Speech API. Voice commands from the user are captured by the microphone. Then converted to text using Google voice API. The text is then compared with the predefined command that is in the command configuration file. If it matches any of these commands, the corresponding bash command will be executed. You can use this system as an interactive voice response system by having the Raspberry Pi respond to your commands via speech. This is achieved by using the Google speech API which converts text into speech. The software systems used are Google Voice and the Speech API. Voice commands from the user are captured by the microphone. Then converted to text using Google voice API. The text is then compared with the predefined command that is in the command configuration file. If it matches any of these commands, the corresponding bash command will be executed. You can use this system as an interactive voice response system by having the Raspberry Pi respond to your commands via speech. This is achieved by using the Google speech API which converts text into speech

### *SMART BUILDING*

Electronic equipment control systems currently still use manual switches to disconnect and connect electric currents

To be able to turn on or turn off electronic equipment at home such as lights, fans, tv and others, one has to do it manually. In addition, if the homeowner is a person with a disability, they will find it difficult to control the electronic equipment at home. So we need a control system that can make it easier for homeowners to control electronic equipment at home, especially for people with disabilities

## *4. THE IMPLEMENTATION*

### *4.1 RESARCH METHOD*

The reseach flow can be seen on Pic 6

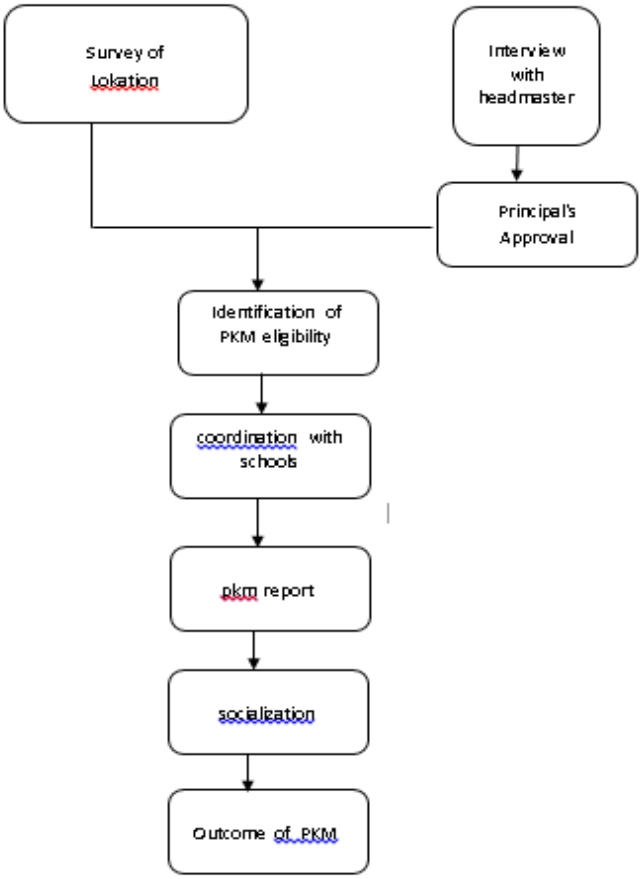


*FIG 3. FLOW CHART OF PKM IMPLEMENTATION METHODS*

### *4.2. THE MATERIALS AND TOOLS USED*

#### *4.2.1.ARDUINO*

Arduino Uno is a microcontroller development kit based on the ATmega28. Arduino Uno is a board from the Arduino family. There are several kinds of arduino bards such as

Arduino Nano, Arduino Pro Mini, Arduino Mega, Arduino Yun, etc..

The Arduino Uno board has 14 digital input/output pins, 6 analog inputs, a 16MHz ceramic resonator, a USB connection, a power input jack, an ICSP header, and a reset button. a microcontroller we can make programs to control various electronic components.

And the Arduino Uno function is made to make it easier for us to do prototyping, program microcontrollers, make advanced microcontroller-based tools. Arduino already uses the C++ high-level programming language which is easy to learn and is supported by a complete library


*FIG 4. ARDUINO UNO*

The advantage of Arduino Uno is that you don't need to make a downloader to download the program that we have made, it is supported by the Arduino IDE, a programming language that has quite a complete library. There is a ready-to-use module/shield that can be directly installed on the Arduino board

Arduino Uno has 6 analog inputs, which are marked with A0, A1, A2, A3, A4, A5. Each analog pin has a resolution of 10 bits (so it can have 1024 values). By default, these pins are measured from ground to 5V, but you can also use the AREF pin by using the analogReference function

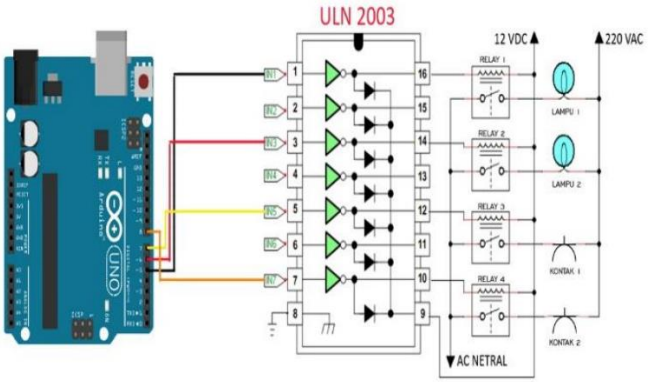


**Fig 5. Arduino Uno's schematic**

4.2.2 .Bluetooth versi 5,0

Bluetooth 5.0 is specially designed to provide secure communication without much interference. The features found in the latest version of Bluetooth are also focused on developing IoT or Internet of Things technology. Bluetooth

version 5.0 also has significant improvements compared to older versions of Bluetooth, such as a wider range, faster data transfer, and being able to carry larger data sizes.

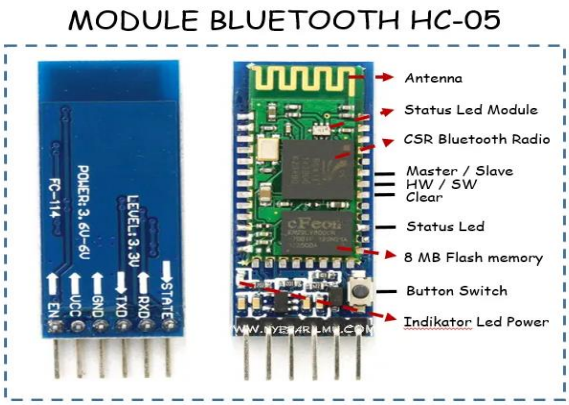


**Fig 6. Bluetooth Module HC-05**

The specifications of this module are

- ISM operating frequency 2.4 GHz
- Bluetooth protocol : Bluetooth tipe v2.0+EDR
- Speed can reach 1Mbps in synchronous mode
- Speed can reach 2.1 Mbps / 160 kbps at maximum asynchronous mode
- Operation voltage on 3,3 – 6 Volt DC
- Consumption of operation current i.e. 50 mA
- Has modulation Gaussian Frequency Shift Keying (GFSK)
- Have security with data encryption and encryption
- Module dimensions 15.2×35.7×5.6 mm

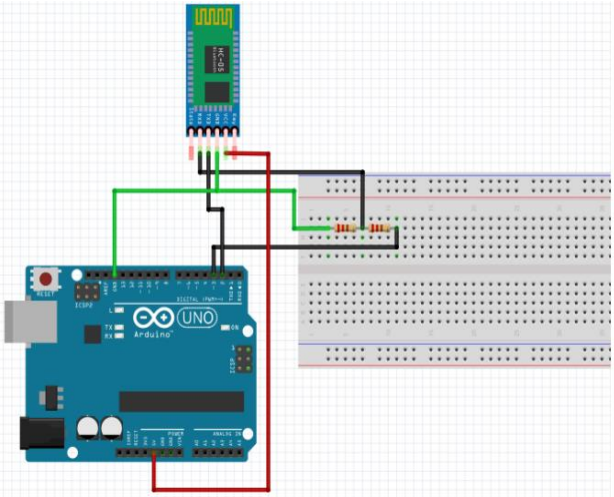

**Fig 7. Arduino Uno's schematic access Bluetooth Module HC-05**

*Table 1*

**Bluetooth Range testing**

| Place | Distance Meters | Status | |
|---|---|---|---|
| | | Success | Fail |
| With obstruction | 1-10 | ✓ | |
| | 11 | ✓ | |
| | 12 | | ✓ |
| | 13 | | ✓ |
| Unobstructed | 1-10 | ✓ | |
| | 11 | ✓ | |
| | 12 | ✓ | |
| | 13 | ✓ | |
| | 14 | | ✓ |

From the table above, it can be seen that at a range of 10 meters, either there is an obstacle or there is no obstacle, the data can be read, while in the unobstacle, the data can be obtained up to a distance of 13 meters, while in the presence of an obstacle the data begins to be unreadable at a distance of 12 meters

### *4.2.3.MODUL RCWL 0516*

The RCWL 0516 module is a motion detection device based on radio wave Doppler radar. The use of the RCWL 0516 sensor as the main module to detect the

movement of objects by measuring the value of microwave waves by utilizing the Blynk application which is easy to use as a display on the user's gadget. The communication used is digital communication

***Tbale 2***

**digital communication**

| No | Room Condition | Sensor results | Sensor Time (Seconds) |
|---|---|---|---|
| 1 | moment | The light on | 40 |
| 2 | No movement | The light off | >40 |

used Arduino Uno microcontroller. The data is sent and will be displayed on the gadget through the Blynk application in the form of a graph that is accessed directly and connected to the internet using the ESP8266 as the receiver of the connection on the device. The results obtained are the RCWL 0516 module has a better level of accuracy in detecting movement

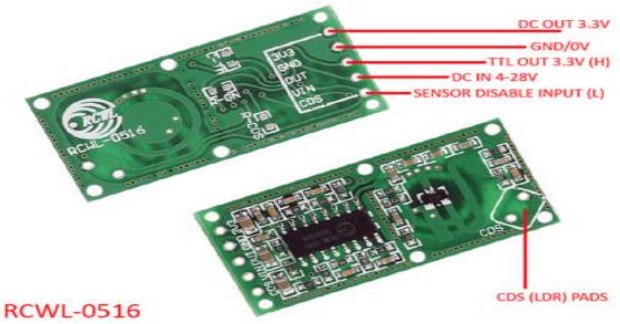


**Fig 8. RCWL-0516 Module**

The RCWL-0516 sensor module can be easily used with many microcontrollers and can even be used alone. It supports 4~28v power supply. The output interface can be used in many mission scenarios, such as directing audible/visual indicators, or processing data deeper into the connection with the microcontroller. During operation, the sensor module RCWL-0516 must not have metal parts in front of it

4.2,4. LDR (Light Dependent Resistor)

The LDR (Light Dependent Resistor) sensor is an electronic component that is included in the resistor family

where the resistance value is affected by the light intensity

A light-sensitive resistor or photoresistor is an electronic component whose resistance will decrease if there is an increase in the intensity of light hitting it. Photoresistor can also refer to a light-dependent resistor (LDR), or photoconductor

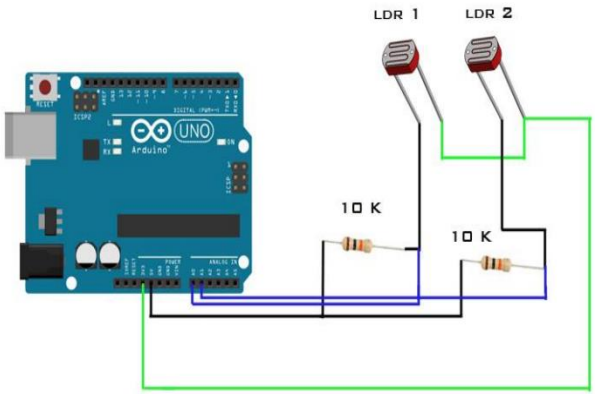


**Fig 9. Arduino Uno's schematic access LDR**

Photoresistors are made of high resistance semiconductors that are not protected from light. If the light hitting it has a high enough frequency, the photons absorbed by the semiconductor will cause the electrons to have enough energy to jump to the conduction band. The resulting free electrons (and their hole pairs) will conduct electricity, thereby lowering the resistance.

### *4.2.5. RELAY*

Relay is an electronic component in the form of an electronic switch that is driven by an electric current. In principle, the relay is a switch lever with a wire wound on an iron rod (solenoid) nearby. When the solenoid is energized, the lever will be attracted because of the magnetic force that occurs on the solenoid so that the switch contacts will close. When the current is stopped, the magnetic force will disappear, the lever will return to its original position and the switch contacts are open again. Relays are usually used to drive large currents/voltages (eg electrical equipment 4 amperes AC 220 V) by using small currents/voltages ( e.g. 0.1 ampere 12 Volt DC)

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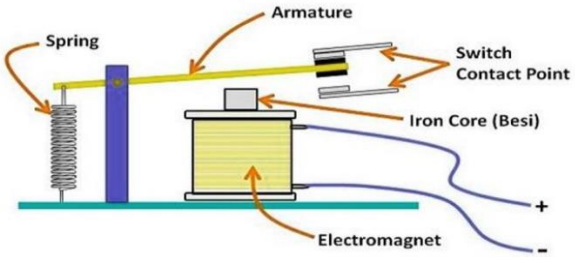


Fig 10. Arduino Uno's schematic access LDR

The use of relays needs to pay attention to the controller voltage and the strength of the relay to switch current/voltage. Usually the size is listed on the relay body. For example, a 12VDC/4 A 220V relay, meaning that the required voltage as a controller is 12Volt DC and capable of switching electric current (maximum) of 4 amperes at a voltage of 220 Volts. It is better if the relay is only used at 80% of its maximum capacity to be safe, lower is safer.

In general, relays are used to fulfill the following functions:

Remote control: can turn on or turn off the tool remotely

### *4.2.6 LCD*

**LCD 16×2 (Liquid Crystal Display)** is a data viewer module that uses liquid crystals as a material for displaying data in the form of writing or images. Applications in everyday life that are easy to find include calculators, gamebots, televisions, or computer screens

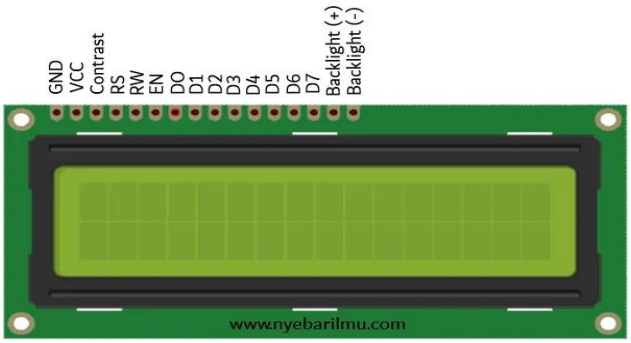


Fig 11. **LCD 16×2 (Liquid Crystal Display)**

The available features include:

- Consists of 16 columns and 2 rows
- Equipped with back light
- Has 192 saved characters
- Addressable in 4-bit and 8-bit modes t

LCD is used to display text, letters, numbers, symbols and images. LCD has been widely used in various fields, for example in electronic devices, such as TV (television), games (Playstation), calculators, computer monitors and laptop displays. LCD is used to display text, letters, numbers, symbols and images. LCD has been widely used in various fields, for example in electronic devices, such as TV (television), games (Playstation), calculators, computer monitors and laptop displays

*Table 4*

**16x2 LCD Text testing**

| No | Spoken Command | | Respondent 1 | Respondent 2 | Respondent 3 | Command results | Disply On LCD | Delay time seconds | Average respond time |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Light-1 | on | ✓ | ✓ | ✓ | on | H | 5.01 | 4.91 |
| | | off | ✓ | ✓ | ✓ | off | M | 5.08 | |
| 2 | Light-2 | On | ✓ | ✓ | ✓ | On | H | 4.20 | |
| | | off | ✓ | ✓ | ✓ | off | M | 4.26 | |
| 3 | Box-1 | on | ✓ | ✓ | ✓ | on | H | 4.28 | |
| | | on | ✓ | ✓ | ✓ | on | M | 4.35 | |
| 4 | Box-2 | off | ✓ | ✓ | ✓ | off | H | 5.15 | |
| | | On | ✓ | ✓ | ✓ | On | M | 5.23 | |
| 5 | All | off | ✓ | ✓ | ✓ | off | H | 5.76 | |
| | | on | ✓ | ✓ | ✓ | on | M | 5.76 | |

### *4.2.7 APP INVENTOR*

This smart room system is based on Bluetooth and is assisted by the MIT App Inventor application that can perform remote monitoring. This system is controlled by an Arduino Mega microcontroller which is connected to a sensor and Bluetooth MIT App Inventor is a software system for creating applications on Android. MIT App

Inventor is an integrated system, MIT App Inventor has several components consisting of Designer Components, Block Editor and Emulators that are used to run and test projects that have been created.

**Fig 12. MIT App Inventor View**

MIT App Inventor is an innovative introduction for beginners to program and create applications that transform complex languages from text-based coding into visual forms, by drag-and-drop building blocks. It is a simple graphical interface that gives even beginners the ability to build a fully functional application in an hour or less

### *5 HARDWARE*

From Figure 13 , it can be explained that the system will control and control all electrical equipment in the room, Bluetooth HC05 is a wireless communication via Bluetooth which operates at a frequency of 2.4GHz which can be connected to all smartphones with an effective range when connected within a range of 10 meters. . The RCWL 0516 sensor will work to read human movements. The sensor reading data will be sent to the Arduino Uno, the LDR sensor will work to read the darkness or lightness of the lights, the sensor reading data will be sent to the Arduino Uno, then it will be displayed on the 16 x 2 LCD, and the 16 x 2 LCD will display the data information displayed on the Arduino Uno.

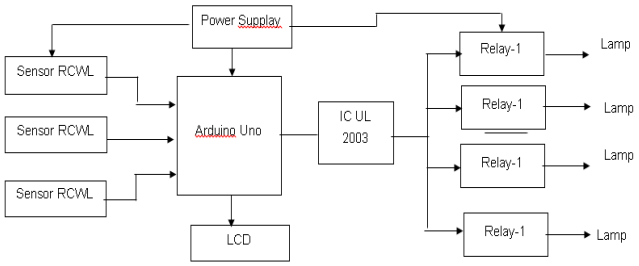


**Fig 13. Hardware Diagram Block**

given by arduino uno, if there is object movement in the classroom, the lights will remain on after the control from the smartphone is carried out, if there is no movement in the room, the RCWL 0516 sensor will send data to arduino uno to give the command the light is off, and the sensor LDR will detect then the data will be sent to arduino and will be displayed on the 16 x 2 LCD.

### *6.RESULT OF THE SOCIALIZATION AND DISCUSSION*

From the results of the socialization, the socialization activities were carried out well as indicated by the level of participation of the participants, the participants received very useful information to increase their knowledge about the dangers

caused by electrical equipment that was often left or left without blackouts. On the other hand, careless use of electrical equipment can present a risk of fire. Occupants of the house are sometimes negligent of electrical hazards such as electrical short circuits and overheating which often cause fires and accidents in the house due to the use of the wrong electrical equipment.

There are three dangers caused by electricity, namely electric shock (electric shock), heat or fire, and explosion. by unplugging electronic equipment from the socket it can reduce the risk of a short circuit. So far, short circuits have always been the cause of the initial fire

the participants obtained very useful information and added insight so that they would like to have more basic material training and make it easier to implement

## *CONCLUSION*

Community deducation activities regarding the Socialization and Implementation of Smart Building with Speech Recognition System Via Bluetooth (counseling) Arjasari District, Bandung Regency have been carried out well and received enthusiastic responses from participants

### *ADVISE*

1. This activity can be held in other schools
2. Further dedication can be done with more advanced material.
3. implementation time so that it can be extended considering the difficulty of transferring knowledge in a relatively narrow time.

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