CHAPTER 1
INTRODUCTION

1.1 Background of Study

There are many approaches in tracking persons. There are many detection devices made for this purpose. Knowing the location of a person corresponds with knowing the important part of context especially the need for location information of a person will lead mankind towards a smart and intelligent living environment.

This section briefly explains about the operational of the device that will be produced throughout this project and the component (sensor) which is most applicable in this project for now.

The device operate when the sensor give the signal indicate there is no one in a room or office. This signal will power up the relay's coil, hence red indicator light will be on (other wise green indicator light will lit). When the red indicator light is on, it also power up the timer for the room light or the office light. This timer will shut down the power supply for the light if there is no one in the room or office for about three to five minutes.

All kind of sensor that can sense the present of an object can be used in this device. Based on the statement above, all kind of sensor that are applicable with the project and could achieve the prime objective of this project will be discuss and take into consideration.

Photoelectric sensor [1] is one of the applicable sensors for the project, works by sensing the other object using its light sensitive material. The sensor consists of emitter and receiver. There are four types of sensor that falls under the photoelectric sensor category.

1. Direct reflection
2. Reflection with reflector
3. Polarized reflection with reflector
4. Thru beam

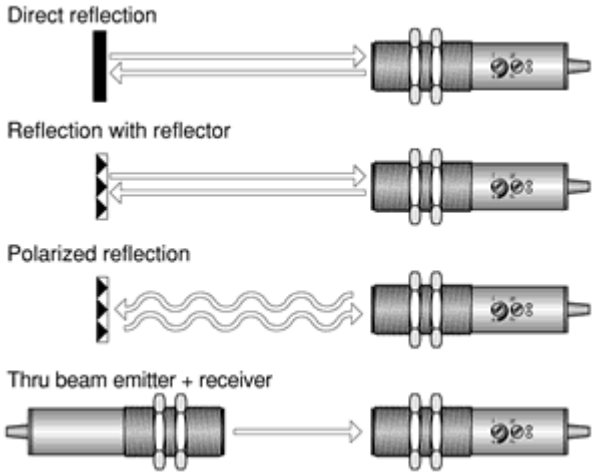

Figure 1: Illustration of the four types of photoelectric sensor. [1]

From this four type of photoelectric sensor, sensor number 2. and number 4. are most suitable. Reflection with reflector will give longer sensing distance and thru beam will give the longest sensing distance.

Temperature sensor is also rational to this device because it will detect heat emitted by human body. So, when there is a present of a person in the room or office, the sensor can give signal to the device. Usually there are three types of temperature sensor that are popular, they are:

1. Thermocouples.
2. Resistance temperature detectors (RTDs).
3. Thermistor.

Pressure sensors are also appropriate for this project. This kind of sensor can be place under the floor or at the seat of the office. Even though it is a bit tricky to find the best spot to locate the sensor, but it is still applicable for the project. There are five types of pressure sensor:

1. Capacitive pressure sensor.
2. Inductive pressure sensor.
3. Piezoelectric pressure sensor.
4. Potentiometric pressure sensor.
5. Strain gauge pressure sensor.

The most used pressure sensor usually employs the second type of sensor. Therefore, in the literature review section, only the discussion on this type of pressure sensor will be made.

1.2 Project Description/ Problem Statement

In this project, the device operates automatically. By using sensor, if it detects a person in a room, it will create a signal to the device and indicator light will on and indicates that the person is in the room. The indicator light will be placed at strategic place. By placing the indicator lights to the strategic places, people will no longer need to go to the specific room or office to see whether the person they are looking is in the room or not.

For example, every time students want to see lecturers, they need to call a lecturer. This is applicable if the students know the lecturer's phone number. But if this is not the case, the students need to goes into the lecturer's office just to identify if the lecturers are in their office. This sometime very time consuming and very tiring. So, if there is some sort of indicator that will be placed at the ground floor of every block that indicates the lecturers are in their room, the students don't have to take the escalator or the stairs anymore just to make sure the lecturers are in the room. In facts if the sensor indicates the lecturers are not in their respective room, they can move on with their plan that vary day without wasting any of their time.

In this project also, the smart detector can act as a smart switch for other appliances or other electrical equipment in the room. Thus, energy also could be saved. By detecting if a person is not in their room or the office, all unused electrical equipment such as lamp, fan, television and etc. will be switch off automatically.

1.3 Objective

At the end of this project, it is to make sure that the device is able to:

1. Operates automatically to indicate a person in their respective room or office.
2. Be an automatic switch for other devices in the room or office such as lamp, fan and etc. if the sensor indicate that there are no people in the room (Energy saving component).

1.4 Scope of Study

This project focuses on the function of sensor in creating an innovative creation of devices that can improve the way of life. This will include:

1. Time saving, and
2. Reducing energy consumption.

CHAPTER 2
LITERATURE REVIEW

2.1 Photoelectric Sensor

These sensors use light sensitive elements to detect objects and are made up of an emitter (light source) and a receiver. Four types of photoelectric sensors are available. [1]

1. Direct reflection (diffused)

Emitter and receiver are housed together and use the light reflected directly off the object for detection. In the use of these photocells, it is important to bear in mind the color and the type of surface of the object. With solid surfaces, the sensing distance is affected by the color of the object. Light colors correspond to the maximum distances and vice versa. In the case of shiny objects, the effect of the surface is more important than the color.

2. Reflection with Reflector (Retro reflective)

Emitter and receiver are housed together and require a reflector. An object is detected when it interrupts the light beam between the sensor and reflector. These photocells allow longer sensing distances, as the rays emitted are almost totally reflected towards the receiver.

3. Polarized Reflection with Reflector

Similar to Reflection with Reflector, these photocells use an anti-reflex device. The use of such a device, which bases its functioning on a polarized band of light, offers considerable advantages and secure readings even when the object to be sensed has a very shiny surface.

4. Thru Beam

Emitter and receiver are housed separately and detect an object when it interrupts the light beam between the emitter and receiver. These photocells allow for the longest distances.

2.1.1 The principle of photoelectric conversion

Electrical power can be converted from electromagnetic radiation by many effects. Early sensor used the photoelectric effect, the change of electrical resistance upon heating by radiation and thermoelectricity. Photocells that convert photons to free electrons in a vacuum tube are seldom used as detector any more, but their operation principle is still the main concept behind TV cameras, image intensifiers, and converters. The internal photoeffect, that we have to deal with its analogue effect, when electron was excited from inside semiconductor to another. Electrode can collect free electrons from the vacuum; the exited electrons within semiconductors can be gathered through suitable contacts to the semiconductor. For sensors, the internal photoelectric effect is important. This is because it is used in elements that are easily combined with semiconductor electronics. [4]

2.2 Temperature sensor

Thermistor

The working principle of thermistor is make use of the variation in electrical resistance of metal with respect to temperature changes, by making use of the temperature resistance relationship of a semiconductor, which exhibits a negative temperature coefficient of resistance. Typically, oxides of metal such as nickel, manganese, cobalt, copper, and iron are employed. There are highly sensitive. Also they are relatively cheap. This kind of sensor can be placed at the seat inside the office. [2]

2.3 Pressure Sensor

Inductive pressure sensor

Inductive pressure sensor sense the pressure by moving a mechanical member which, in turn, changes the inductance. The mechanism is based on the relative motion of a core and the inductive coil. A sensor with two coils is preferred as it can eliminate the temperature sensitivity problem which always occurs with an inductive single-coil sensor. Based on Hordeski [3], a motion of about 0.08 mm produce an output voltage of 100 mV for this kind of sensor. Therefore, these sensor produce a high output, responding to both static and dynamic measurements, providing continuous resolution and having a high signal-to-noise ratio. [2]

2.4 UV-Visible and Near IR Semiconductor sensor

The interaction, which are absorption and radiation, between incident photons and the charge carries inside a solid state material is the fundamental physical effects for sensing radiation in the spectral vicinity to the visible wavelengths and has often been described [5,6,7,8]. Electrical signal which can be measured was only part of radiation absorbed inside the material can bring about. Energy band structure of the material can determine the absorbing properties of a material. For wavelength surrounding the visible spectrum (about 200 nm to 2000nm) the well-known semiconductor germanium, gallium arsenide, and silicon are suited for detecting optical radiation. Gallium arsenide absorbs radiation at wavelengths up to about 900 nm, silicon op to 1100 nm and for longer wavelength near 1.8 um the best choice is germanium. However, gallium indium arsenide detectors are preferred to germanium in fiber optic application. These materials are usually used in UV-Visible and Near IR Semiconductor sensor.

2.5 Classification of Sensors and the Effects

Table bellow shows the category of the sensor and the examples of associated properties useful in sensing.

Table 1: The Six Prime Categories of Energy Involved in Sensing Processes. [9]

Prime category	**Examples of associated properties useful in sensing**
Chemical	Concentration, reaction rate, redox potential, biological properties
Electrical	Current, voltage, resistance, frequency
Magnetic	Field intensity, moment, permeability, flux density
Mechanical	Position, velocity, acceleration, force, stress, pressure, strain, flow, mass, density, moment, torque, shape, roughness, orientation, viscosity.
Radiant	Intensity, energy, phase, wavelength, amplitude, transmittance, polarization.
Thermal	Heat, temperature, flux

2.6 Smart Sensing

A sensor is often uphold as smart when its maker feels that its electronic elements are more complicated than other similar products on the market. Making a sensor smarter is really just another way of adding value to the customers. Come of the value that can be added to a sensor to make it work smart is relatively simple. For example, most solid state sensors today are operated in conjunction with computers or microprocessors that operate on digital pulses, but many of the sensors are analogue. So, by adapting an analogue signal to digital one, the sensor is competent of smarter operation, and it can be assume some of the logic function that would otherwise have to exist in the microprocessor. More sophisticated capabilities can also be added to a sensor, such as compatibility with multiplexed communication systems, advanced logic capabilities, and sensor self-diagnostics. [10]

All sensors could have as a feature one or more of the types of sensing sophistication outlined below:

1. Conversion
2. Environmental compensation
3. Communication
4. Diagnostics
5. Logic/Actuation

2.7 Similar System

There are also some systems that use similar discipline by means of using sensors in the device for some similar purpose with this project.

2.7.1 Parking Space

There are devices that has been installed in the parking lot at Sunway Pyramid and The Mines shopping complex. The system will operate or indicate by means of continuously emit red light just above the parking space if the parking space was taken. And if the parking space is free, it will emit green light. This system is using some sort of light sensitive sensor in it and it is quite similar to this project because it apply sensor in a device for indicating something.

Since the system is working straight forward and less complicated than my project, I suspect that it uses a very simple connection of electronic devices. Unlike my project, more complicated connection was used to fulfill the objective.

2.7.2 Attendance Indicator

In Ipoh Specialist Hospital, there is a device that indicates the attendance of the doctors in the respective day. The device will operate by emitting light from an indicator light at the side of the doctor's names. But this system did not indicates whether the doctor is in a specific room because the doctor can be anywhere in the hospital treating their patient in the hospital.

The idea of indicating the person's attendance is practiced in this system. Indicates whether the person is in their respective room of office is not apply here. This device not even operates automatically and maybe not even use sensors like my project stressed on, which is automation.

2.8 Automated Consumers Products

Automated consumer products are rapidly emerging in the form of smart cars, smart homes, domestic appliances and toys. [11]

2.8.1 Smart Cars

It will only possible to accommodate more sensors if a distributed sensor bus is used instead of a star connected sensor system. Only smart sensors make smart cars economically viable.

2.8.2 Smart Home

House can only accommodate more sensors if a distributed bus system is used instead of a point-to-point network.

2.8.3 Smart Domestic Appliances

There maybe time when every house comes with a robotic butler, supplying the needs of the family members.

2.8.4 Smart Toys

Toys can become lifelike if they are given sensors.

CHAPTER 3
METHODOLOGY

3.1 Procedure Identification

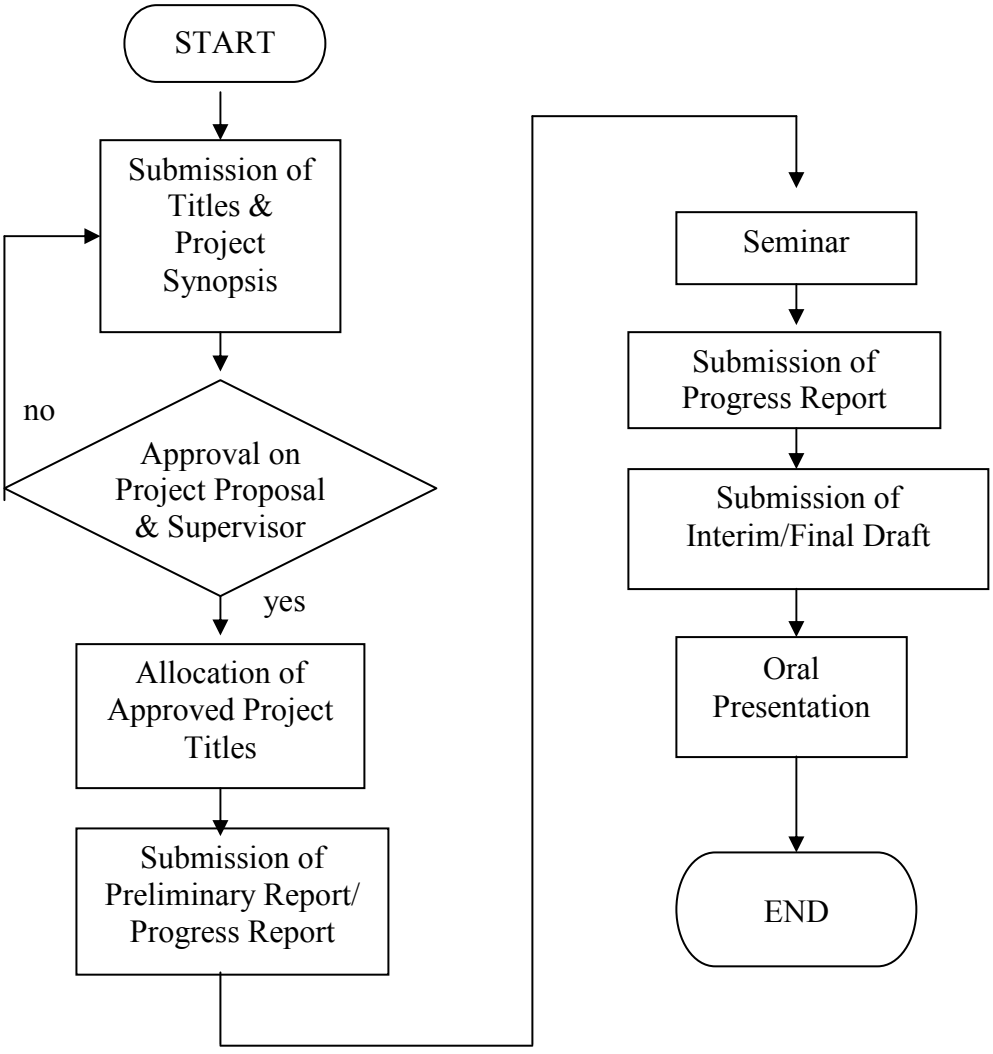

Figure 2: Flow Chart FYP1

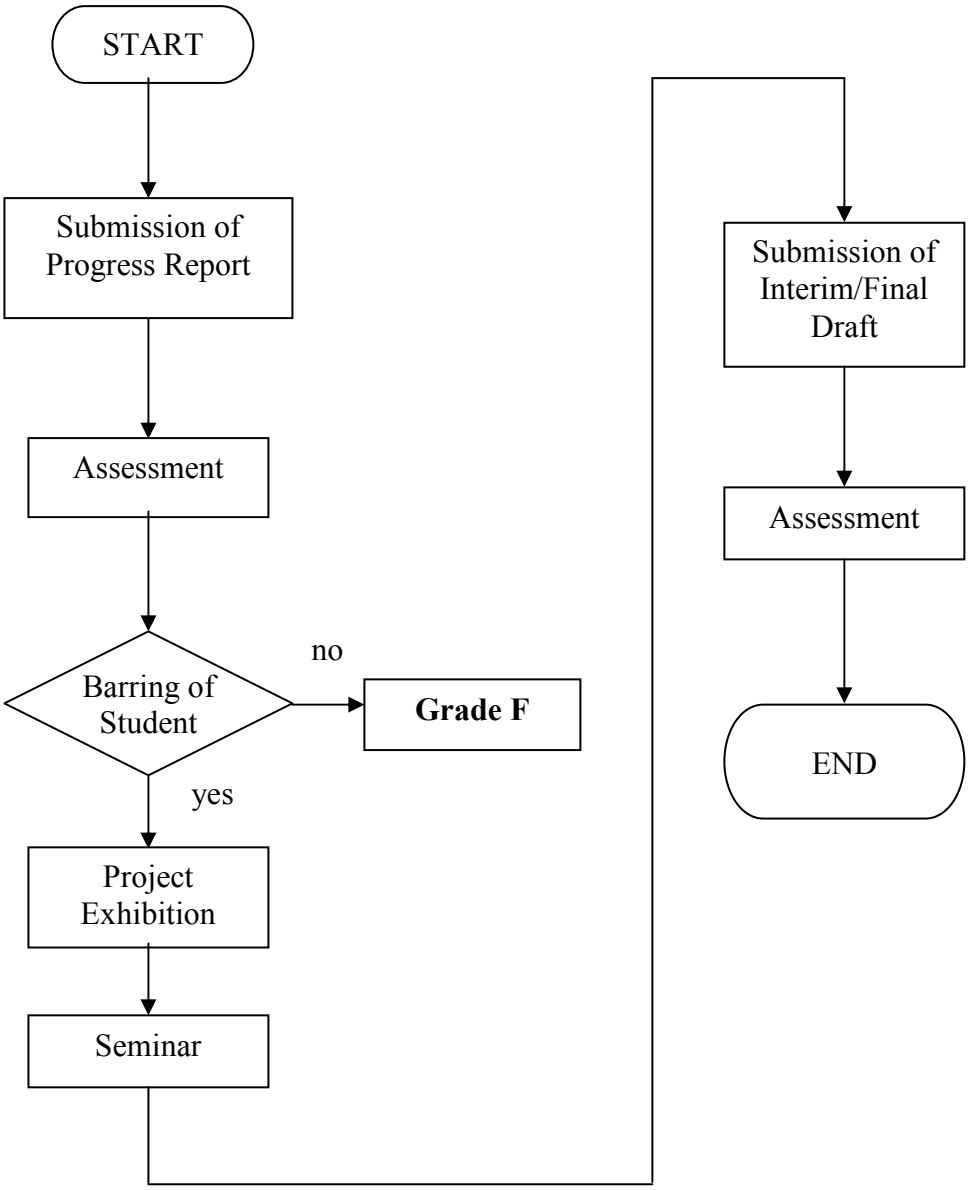

Figure 3: Flow Chart FYP2

The methodology is as follow:

Firstly, a research has been made on the most suitable sensor that can meet the requirement of the device used throughout this project. Secondly, I have figured out the connection of the device and other added value that can enhance the functionality of the devices. And lastly, a working prototype was constructed for the project and some tests or data gathering have been done on sensor that been used to maximized the functionality of the device.

By the end of FYP1, the connection of the device has been figured out. So, when it comes to constructing the device, I already have a reference and if there is any problem regarding to the device, I have a place to refer to.

So, I have surveyed some of the retailer and search the internet for the tools and materials that have been used in my project. Constructing and experimenting on the system of the device have been performed at the second part or on the FYP2. In the end, the system has been done and a working prototype can be displayed for presentation.

3.2 Tools and Equipments Required

These are some of the equipment that will be used to create the prototype of the project:

1. Magnetic relays
2. Timer
3. Indicator Lights
4. Step down transformer (220/24V)
5. Magnetic circuit breaker (MCB)
6. Motion Detector (PHILIP)

CHAPTER 4
RESULT AND DISCUSSION

4.1 Project Deliverables

The configuration has been constructed. The process fits every part of logical sequence that the prototype should be performs. Relays and timer was placed in the right arrangement so it will perform the task orderly.

After long deliberate on how to put the equipments and tools together, I have come with the configuration on the next page:

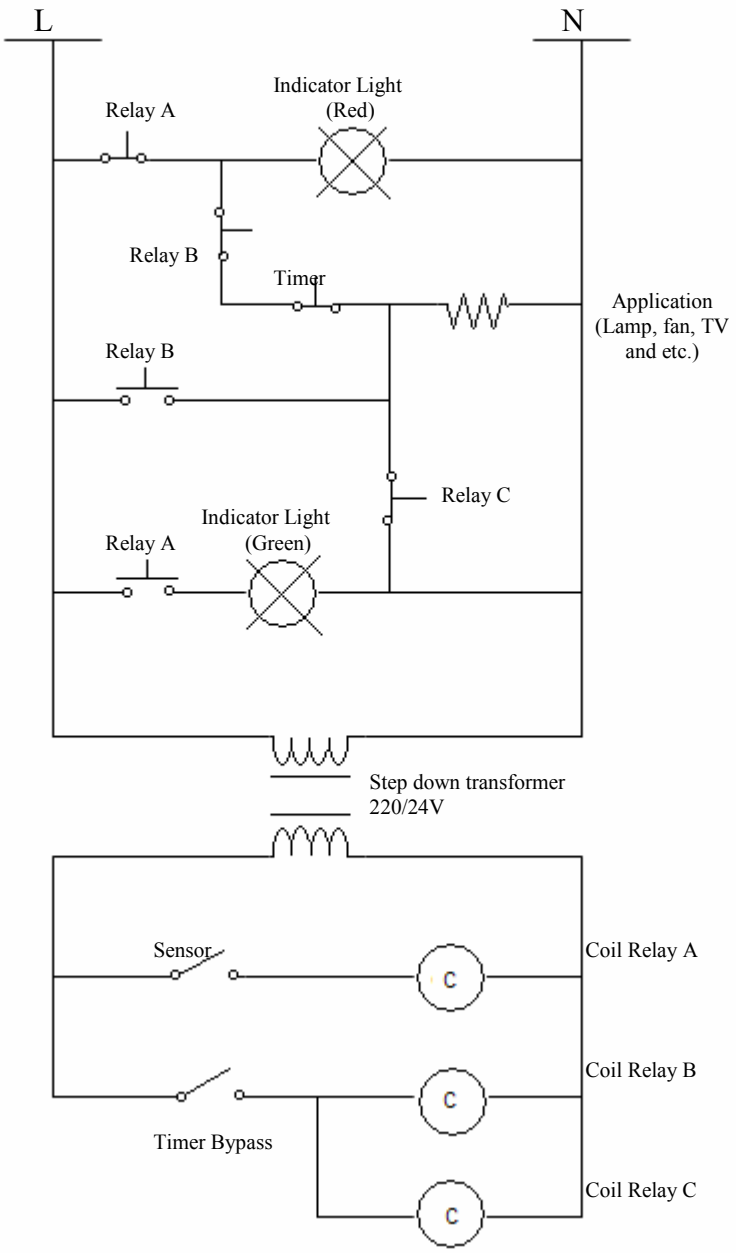

Figure 4: Equipment arrangement and setting. (Logical sequence)

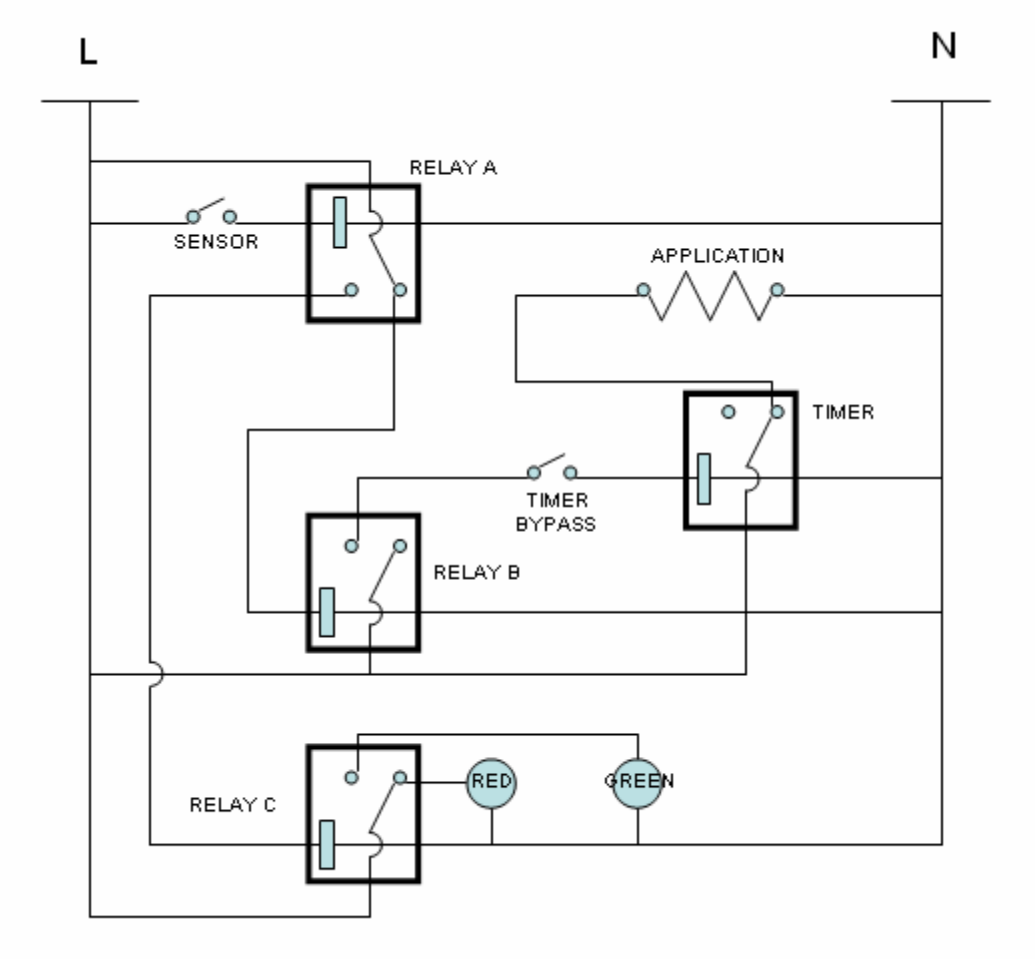

Figure 5: Equipment arrangement and setting. (Actual connection)

This is the working prototype that has been constructed for presentation purpose.

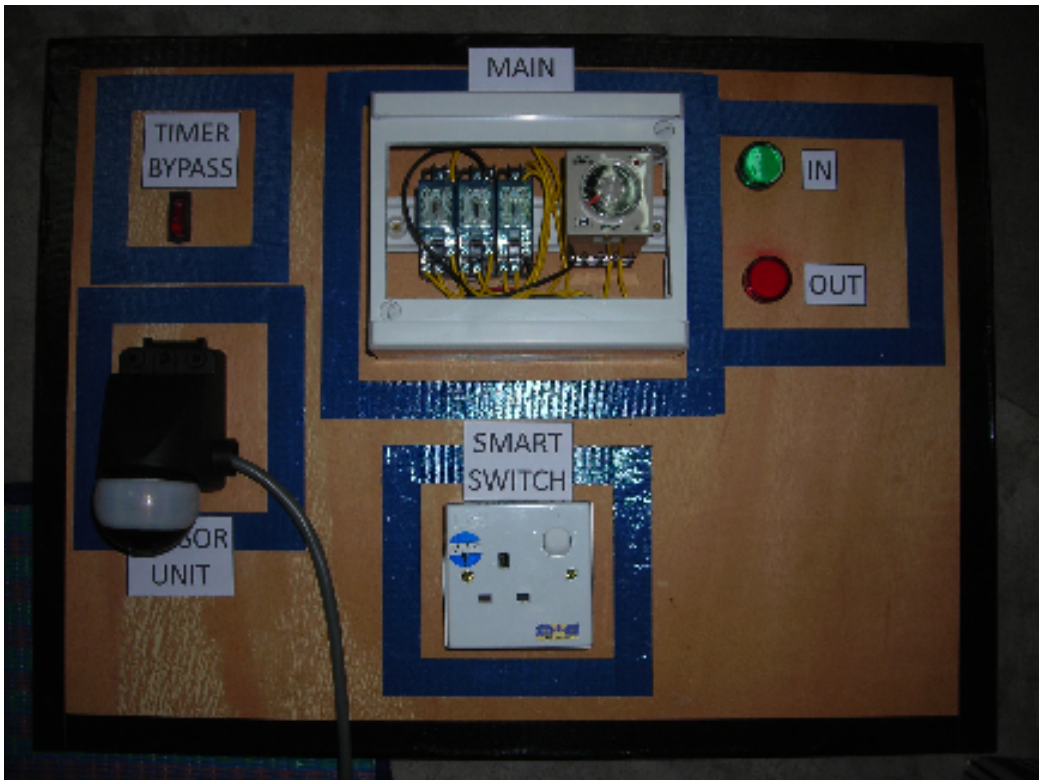

Figure 5: Fabrication of the Device Display

4.2 Equipment's Function

1. Transformer (Step-down 220/24V)

   This transformer will be applicable if the operation of the sensor and the coil relays need lower voltage. If there is somehow the sensor and the relays operate at 220V, this transformer will not be needed.

   It is also subject to change if the sensor operates at lower or higher voltage than 24V.

2. Timer

   Timer is used to set a delay on the added value of this project.

3. Relay

   Relays are used to be a router for current when the sensor gives signal to the system.

4. Indicator Lights

   In this project, green indicator light and red indicator light will be used. The green indicator light will indicate that a person is in the respective room/ office. The red indicator light will indicate that there is no one in the respective room/ office.

   At some angle, if a client wants another indicator light that indicates a person just left the room/ office in less than certain time, another indicator light such as yellow in color can be used.

5. Motion Detector

In this project, motion detector was used to detect the presence of people in the room. This detector is the most crucial part of the device because it will be the main input to the overall system.

4.3 Summary of the Project Operations

Table 2: Summary of the Project Operations

Sensor	Switch Bypass	Indicator Light		Application (Light, fan etc.)
		Green	Red	
0	0	0	1	0
1	0	1	0	1
0	1	0	1	1
1	1	1	0	1

1=ON, 0=OFF

4.3.1 Operation 1

When the sensor indicate there is nobody is in the room and the switch bypass was in off mode, the red light will on and the automatic switch will be in off mode.

4.3.2 Operation 2

When the sensor indicate there is someone is in the room and the switch bypass was in off mode, the green light will on and the automatic switch will be in on mode.

4.3.3 Operation 3

When the sensor indicate there is nobody is in the room and the switch bypass was in on mode, the red light will on and the automatic switch will be in on mode.

4.3.4 Operation 4

When the sensor indicate there is someone is in the room and the switch bypass was in on mode, the green light will on and the automatic switch will be in on mode.

4.4 Advantages

There are many advantages for using this device. First of all, this device is not just applicable in UTP, but throughout all universities and other office building out there.

Since it operates automatically, it will save time as the user just need to set the device just once to meet the user's requirements.

Automatic switch for the other application in the rooms and offices will ensure that no more electrical energy wasted. This device will lead to a step to overcome the global warming issue.

4.5 Cost

Table 3: Cost of Main Components

Main Components	Quantity	Unit Price (RM)	Total Price(RM)
ANLY Relay AC240	3	12.00	36.00
Relay Socket	3	3.80	11.40
AC240 Indicator Light (R)	1	3.00	3.00
AC240 Indicator Light (G)	1	3.00	3.00
Motion Sensor (PHILIP)	1	110.00	110.00
ANLY Multi Range IC Timer	1	55.00	55.00
8 Pin Relay Based Socket	1	3.50	3.50

Total cost for main components for the device = RM 221.90

Table 4: Cost of Presentation and Casing

Presentation & Casing	Quantity	Unit Price (RM)	Total Price (RM)
Power Socket	1	3.50	3.50
8 Ways Fuse Box	2	8.00	16.00
Switch	2	2.50	5.00

Total cost for presentation and casing for the device = RM 24.50

Total constructing cost for the device = RM 221.90 + RM 24.50

= RM 246.40

4.6 Installation Suggestion (Lecturer's Room in UTP)

Motion sensor is recommended to be place at the height in range of 1.8 - 2.4m (5.9 – 7.8 Ft) for optimum detection.

Display panel is recommended to be placed at the ground floor of every building, near the stair case and the elevator so it is easier for the students to identify whether the lecturer is in the office or not.

Timer setting. Since the motion sensor has its own delay that can manually set, the timer will be the backup or the additional/alternative delay for the automatic switch components of the device. The timer can be set manually by the user to meets the user's requirement.

4.7 Testing

The sensor that being used in this device is very sensitive. After performing some test on the device, it can detect human presents up to 12 meters. This could be very unreliable if the sensitivity is in that state. By reason of that, this device also have problem working properly in a very cold condition and very hot condition. The effect of detection the moving temperature difference between two objects is unpredictable.

However, when adjusting the device to its ideal condition of working state, all of the operations stated in Table 2 will be performed accordingly.

After encounter these effects, other suitable sensor could be replace the current sensor to make sure the operations to be more reliable. It is also recommended that other added feedback system to be include ensuring the reliability.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

At the end of this FYP2, the device has been completely constructed. All suitable components were identified. After the device has been constructed, a small test has been conducted to check the efficiency of the sensor used in the device. This is necessary because it will determine whether to use the sensor or to replace with other sensor based on its efficiency.

Based on the methodology, this project did carry out its objective, and the project did success as compared with objective. Through more study and literature review, this method will subject to change if there is a better way towards completing and improving the device for this project in the future.

5.2 Recommendation

There are rooms for improvement for this project. First of all, the device can be made by cheaper components. So, should this project to be continue by other researchers, they should find some other equipments and tools that cheaper to replace with the current equipments and tools that been used.

There are also some other application that can be included to the device such as security alarm for security purposes and many more. This device can be a benchmark for a simple “smart” rooms and offices device in the future.

The study of market demand for this device also can be made to see how much this device could penetrate the market. This will ensure the future of this device to be valid or obsolete.

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APPENDICES