UNIVERSITI TEKNIKAL MALAYSIA MELAKA

EGG INCUBATOR WITH BLUETOOTH CONTROLLER INTERFACE WITH POWERED ANDROID DEVICE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Type your Department''s course here) (Hons.)

by

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TAJUK : **Egg incubator with Bluetooth controller interface with powered android device.**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Electronic Industry) (Hons.). The member of the supervisory is as follow:

……………………………….

MR KHAIRUL ANUAR BIN A RAHMAN

(Project Supervisor)

ABSTRACT

Nowadays, a lot of technologies and system can be implement to improve the efficiency of the incubating process. Hatching process of the egg should be provide with the necessary heat and humidity in an incubator. Failure to provide proper temperature to the egg can give an effect to the egg health. The importance of temperature and relative humidity to be controlled by the android powered device is a reason for this project to be done. Three actuator that are heat source(bulb), fan and humidifier will acted on the measurement data from three parameters that are temperature, relative humidity and time period. Throughout the advanced technology, the Bluetooth interfacing is one of the excellent tools in transmitting and receiving ASCII and binary data between the devices that connected over the Bluetooth interface. The transmitter transmits the data to the receiver on the android powered device and display in the interface. When the three conditions occur during the process, the android powered device able to monitor and control the system. The system developed is focusing on the stabilized the temperature and the relative humidity according to the setting target temperature and the target relative humidity. The process stabilized is done most by the sensor and actuator inside the mechanical section of the incubator. The incubator setting can be set using either auto setup or manual setup directly from the incubator or the android device.

ABSTRAK

Pada masa kini, banyak teknologi dan sistem boleh digunakan untuk meningkatkan kecekapan dalam proses pengeraman telur. Proses pengeraman telur mestilah dilengkapi dengan penyediaan haba dan kadar kelembapan yang sesuai di dalam inkubator. Penyediaan suhu yang tidak sesuai boleh memberi kesan kepada kesihatan telur. Kepentingan pengawalan suhu dan kelembapan oleh peranti berkuasa android adalah satu sebab untuk projek ini perlu dilakukan. Tiga penggerak seperti sumber haba (mentol), kipas dan „humidifier" akan bertindak atas data pengukur dari tiga parameter seperti suhu, kadar kelembapan dan tempoh masa. Seiring dengan kecanggihan teknologi, pengantaramukaan Bluetooth adalah salah satu medium pengantaraan yang sangat baik untuk memancarkan dan menerima ASCII dan data binari antara peranti yang berhubungan melalui Bluetooth. Pemancar menghantar data kepada penerima pada peranti berkuasa android dan paparkannya. Apabila tiga keadaan (parameter) berlaku semasa proses, peranti berkuasa android akan memaparkan keluaran yang dihasilkan oleh penggerak. Semasa tiga data pengukur berada dalam proses, peranti berkuasa android dapat memantau dan mengawal system ini. System pengeram ini memfokuskan pada menstabilkan suhu dan kadar kelembapan mengikut suhu sasaran penetapan dan kadar kelembapan sasaran. Proses pengstabilan dilakukan oleh sensor dan penggerak dalam seksyen mekanikal pengeram tersebut. Tetapan pada inkubator boleh ditetapkan dengan menggunakan sama ada tetapan automatik atau tetapan manual secara terus dari inkubator ataupun peranti android.

DEDICATIONS

I lovingly dedicated this Final Project Report to:

My beloved family members

ACKNOWLEDGMENTS

I would like to thanks Allah S.W.T for helping and blessing me through all the obstacles that I faced during the work of this project. As my individual project, this project would not have been possible without considerable guidance and support. I would like to record my gratitude to Mr. Khairul Anuar Bin A Rahman as my supervisor, that advise, guide me and giving me extraordinary experiences throughout the work. I gratefully acknowledge my family as they are the backbone of this project to become successful. Thank you for the contributions and helping me in my final year project. Lastly, it is a pleasure to express my gratitude whole heartedly to lecturers, classmate and friends who contributed to this project directly and indirectly.

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LIST OF SYMBOLS AND ABBREVIATIONS

IDE	=	Integrated development environment
LCD	=	Liquid crystal display
PC	=	Personal computer
CPU	=	Central processing unit
BT	=	Bluetooth
GPS	=	Global Positioning System

CHAPTER 1

INTRODUCTION

1.0   Introduction

This chapter contains the overview of the project and problems that leading to the objectives. In this chapter, the scope and the thesis outline were stated.

1.1   Overview

The project is about to make an incubator that can be use to incubate several type of animal egg. The egg that can incubate through the machine may be snake, duck chicken, iguana and quail. The power supply is use to supply the light and fan that works as a heater for incubating. A control system is use to control the temperature of the surrounding inside the machine. Although, the machine can be control by an android powered device by using Bluetooth interfacing. From the controller, user can switch the surrounding temperature inside the machine manually and there is some option of temperature that can be choose by the user to be set.

Bluetooth interfacing is one of the medium that used to transmit and receive ASCII and binary data between the device that been connected through it. Bluetooth as open wireless technology that able to exchanging data over short distances by using short wavelength radio transmissions from fixed and device using a packet-based protocol. Several important parameter that being monitored such as temperature from the incubator can be monitored from the android powered device can be done by using this medium. As known, warmth is important for the hatching process of the egg in the incubator.

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1.2 Problem Statement

Hatching process of the egg should be provide with the necessary heat and humidity in an incubator. Failure to provide proper temperature to the egg can give an effect to the egg health. There are so many people that owned exotic animal as their pets claimed that their pet failed to hatch their egg to a new-born baby animal. This is because the environment and temperature of surrounding where the egg is hatching by the parent animal is not suitable for the incubation process. Failure to hatch the egg may got their pets into depression.

1.3 Objective

The main objective as a guideline for this project;

1. To implement the use of Bluetooth interfacing in monitoring the system control to be more precise and reliable.
2. To create a portable temperature monitoring device with an ideal condition in order to improve eggs care and safety.
3. To control and stabilize the temperature and relative humidity inside the incubator.

1.4   Scope

The scope of this project are as follows;

1. Arduino UNO as a micro-controller that monitor the system.
2. Two parameters monitored such as air temperature and relative humidity of the incubating process. The two actuator responded to the measurement are; humidifier (relative humidity) and bulb (heat source).
3. Bluetooth module installed on the Arduino board will transmit and receive the information when connected to the android powered device.
4. The distance of the Bluetooth interfacing able to transmit and receive the signal at transmitter were analyse.

1.5   Thesis Outline

This thesis divided into five chapter. Chapter 1 describe the objective of this project, problem statement and the scope of study. In chapter 2, there is a complete literature study of the Bluetooth interfacing for sending and receiving data, incubator working system and previous work. In this chapter also include the theory and information needed for this project. In chapter3 explained the method used to achieve the project objectives. The software program was discussed in this chapter, followed by the circuit and hard ware wiring connection. The chapter 4 had shown the results that were obtained with the details explanation made base on the overall results obtained. Finally, Chapter 5 contains the conclusions and future recommendation related with improvement ideas.

CHAPTER 2
LITERATURE REVIEW

2.0   Introduction

In this chapter, some elaboration on the low power wireless technologies was stated. The discussion about the previous study and reviews about present technologies by the previous inventor were state. The fundamental of Bluetooth interface was explained based on the finding from a variety of source. All the material and information that were used in this project are from journal, book and trusted website.

2.1   Low Power Wireless Technologies

For over a decade, there are many new low power wireless technology standard started to grow up in this world aiming for the different industrial fields, such as home and building automation, health, sports and fitness, medical, sensor networking, and even the automotive field. According to (Iniewski, 2013), the desire characteristic that should have at this low power wireless technology that make it worth to be implement are simple, it should capable to sending low amount of data payloads, but at the same time with a very low latency and ultra-low power consumption. There are many types of low power wireless technologies that were used in industries which are GSM, ZigBee, Wi-Fi and Bluetooth. Each of them have their own technical specification that makes them specials. All of this technologies is able to use as a medium to transmit and receiving the data for monitoring purpose.

2.1.1 Theory of Shape Based Matching Application

ZigBee is one of the low power wireless technology that was based on the Institute of Electrical and Electronics Engineers (IEEE) Standard 802.15.4 standard. The low data rate transmission application that use the ZigBee typically need a long battery life to implement it. ZigBee has a define rate of 250 Kbit/s, that is suitable to implementation of data transmission from the input device or the sensor.

ZigBee been used in industrial space and is target towards application such as smart meters, home automation, remote control units and also for the customer or industrial equipment that require a low range wireless data transfer.. ZigBee technology specification is quite simple and less expensive than Bluetooth and Wi-Fi.

According to (Farahani, 2011), ZigBee"s channel operates at frequency of ISM 2.4 GHz. ZigBee has a limit for a transmission of data from 10 to 100 meters line-of-sight that depends also to the environmental characteristic due to its low power consumption. It can transmit the low data to the long distance receiver by passing the data through the mesh network of intermediate device.
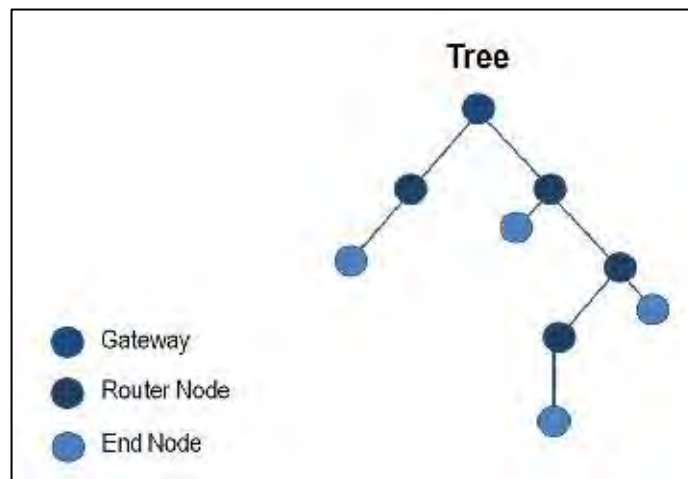

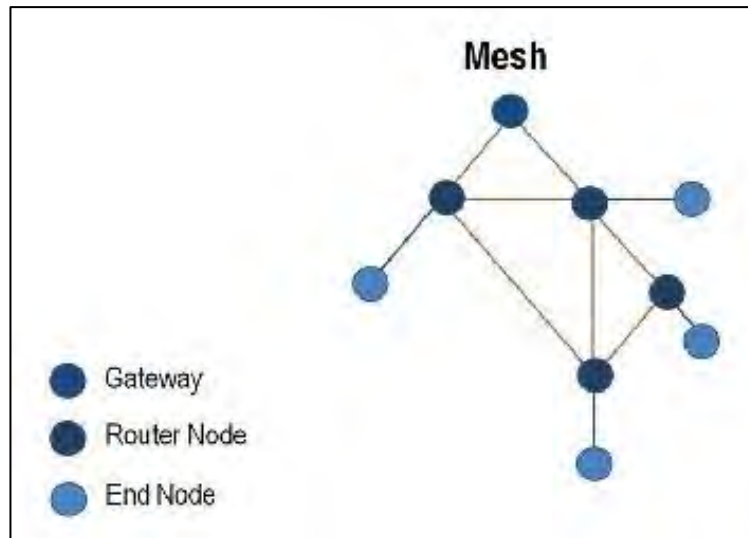Figure 2.1 cluster tree network topology

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Figure 2.2 cluster mesh network topology

ZigBee actually supports the both network layer, tree network and generic mesh network. Every network must have one coordinator device that been tasked to control the network parameters and the basic maintenance. The coordinator should be the central nodes within the star network. By this the ZigBee allow the mesh and tree network to use the router to extent the communication at network level.

2.1.2   Wi-Fi

Wi-Fi seems to be the one of the low power wireless technologies that easy to transmitted and received data. Nowadays, Wi-Fi increasingly becoming the preferred mode of internet connection at all over the world. The frequency of emitting at 2.4GHz to 5GHz is provides by the Wi-Fi connectivity is use to transmit and received the data. The frequency that use to emitted the data is depends on the amount of the data transferred. The area that provides the Wi-Fi connectivity is called as Hotspots. To enable the Wi-Fi connectivity, it is important to have the wireless router to be plugged to the internet connection and also the setting required are installed properly.

The information is transmit through the Wi-Fi network by implement the radio waves like a mobile phone. The device must be include a wireless adapter to convert the information to a signal that can be handle by the radio waves. By using the antenna the data will be transmit to a decoder called a router. After the decoder done decode the information to a signal, it then will be send to internet network.

For several years from now, according to (Duntemann, 2012), there are a lot of improvement been done to the wireless-fidelity IEEE Standard 802.11 wireless networking standard, which able to reduce the power consumption used, including 802.11v and other proprietary standards. It is very efficient to use Wi-Fi networking medium to transmit large data through high speed data transfer and it is not suitable to use over the coin cell operation.

Wi-Fi are highly dependent on the ability to transmit and receive radio waves with minimal interference and less of obstruction. The number of people using Wi-Fi network and the user's distance from the access points affect wireless performance. As the user are far away with the access points, the signal may degrade and throughput number may decline. The signal propagation mechanisms like diffraction, reflection also determine the signal behaviour and it need to be considered to predict the signal strength. The propagation can occur when there is an obstruction between the transmitter and receiver.
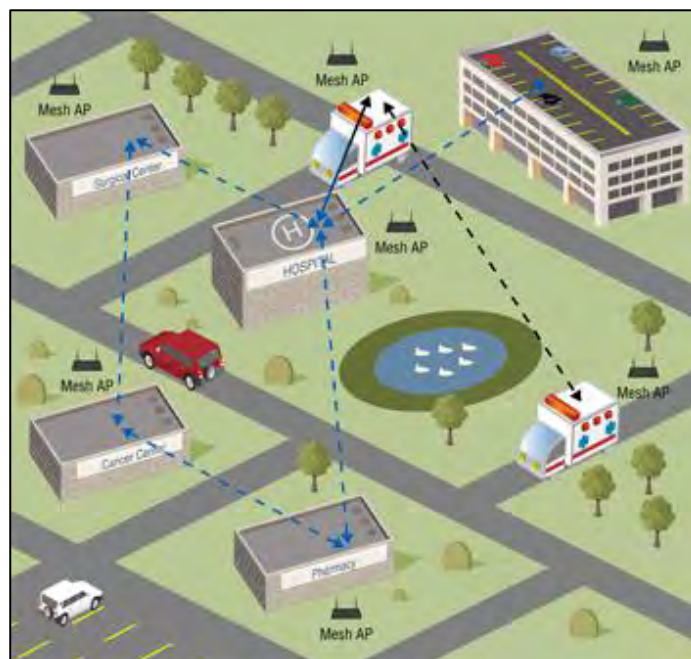

Figure 2.3 Wi-Fi mesh networks topology

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Wi-Fi network work to transmit the information through a network that known as mesh network. As shown in Figure 2.3 above, mesh network is a communication network that made of the radio nodes that been organized by a form of wireless ad hoc network. The mesh network are consist of a communication network between the mesh clients, mesh router and gateways. The mesh client could be a laptop, cell phone and other wireless device and mesh routers forward traffic networks from a gateways to another gateways.

2.1.3   Bluetooth

Bluetooth is a medium or a network that acts as a connector between two electronic devices for the communicating purpose. The Bluetooth is a specification for a low cost component that provide temporary connection between two electronic devices through a communication network which known as an Ad-Hoc network. One of the advantage to use this Ad-Hoc network is the network need only a little configuration and adjustment to use it.

There are three classification in Bluetooth that difference on the power that it needs to broadcast. The actual range of Bluetooth broadcast is depends on the surrounding. According to (Heydon, 2012), for the first class, Bluetooth need to use maximum power output of 100 mW or 20 dBm for the operational rage of 100 meters. Second class is Bluetooth use maximum power output of 2.5 mW or 4 dBm to operate at 10 meters range. For the last class is Bluetooth use maximum power output of 1 mW or 0.1 dBm to operate at 0.1 meters range.

Bluetooth system operates at a frequency around 2.4 GHz. The real frequency spectrum that used by Bluetooth to communicate is between 2400 MHz to 2483.5 MHz there are 79 RF (radio frequency) Channel inside the operating frequency of Bluetooth that are separated apart by one megahertz from each other.

For security section, it is very important to tight the securing of the network from being discovered by the hacker. If the network is discoverable, anyone in the range point can do a device discovery and find the Bluetooth device. The hacker also may determine which service that our device is offering and they may tried to connect with them. In other to handle the threat, the Bluetooth network specification defines a security model based on three level; authentication, encryption and authorization. A security manager is used to manage the security transaction between the Bluetooth connections.
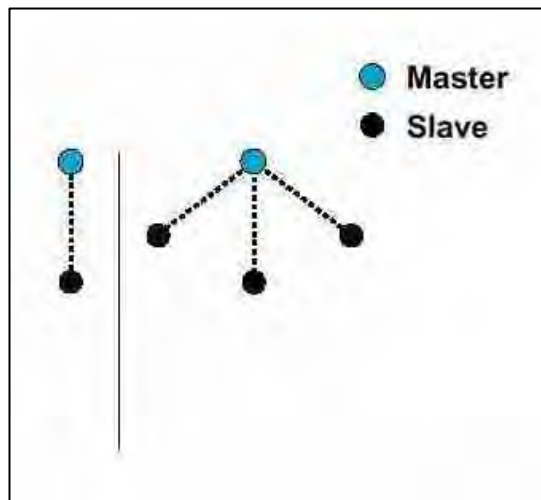

Figure 2.4Bluetooth master-slave topology

According (Heydon, 2012), Bluetooth uses a technology called frequency-hopping to ensure that it is resilient against interference. Bluetooth is based on frequency-hopping spread spectrum radio technology, making use of a packet-based structure in a master-slave arrangement.

That is, information is transmitted in discrete chunks known as packets, and in each piconet, there exists a master device that dictates which of the other (slave) devices it is communicating with. Devices can also switch roles from master to slave and vice versa, and they belong to multiple piconets, where they are master in one network and slave in another. These two connected piconets are then referred as a "scatternet".

2.2 Low Power Wireless Technologies Comparison

Referring to Table 2.1, the comparison are made to the three type of low powerless technology at aspect of pricing, working range, security, power consumption and the latency.

2.1 comparison on low power wireless technologies

Type of network	range	security	Power consumption	latency	pricing
ZigBee	100m-300m	high	low	20ms, wake-up time: 30ms	low
Wi-Fi	150ft.-500ft.	high	high	1.5ms	high
Bluetooth	50m (max)	high	low	2.5ms	low

After analysing the benefits of each specification on the low power wireless technology of ZigBee, Wi-Fi and Bluetooth, I decide to use Bluetooth as my network medium to communicate between the incubator and android powered device for controlling the system purpose. It is because Bluetooth have a high priority in security and it can used to transmit and receiving large amount of information without consume large power compared to the Wi-Fi network that using large power consumption to transmit large amount of data.

Bluetooth also have 2.5ms of latency working. The latency of a wireless system can be defined by a user action sent to a receiving device. A common scenario is gaming, where a user hits a button on the controller and the effect is perceived to be instant at the console. It is not acceptable that a user presses the trigger and must wait for a bullet to appear. Latency is also critical in applications such as HID (mice and keyboards), sports and fitness (instantaneous body readings) and security devices. It should to take into account to have the fast of latency to make sure the system is working fast.