DEVELOPMENT OF SWIFTLET HOUSE MONITORING SYSTEM BASED ON IOT

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ABSTRACT

Switflet house is a place for swiftlet breed that refers to a building was made by humans.Ttemperature and humidity need to be maintained according to the original habitat in the cave. The swiftness and safety of the swiftlet is the key to success. Because of that reason, swiftlet house need the system that can maintain the temperature, humidity is relatively constant and monitoring condition of swiftlet house without disturbing the swiftlet.

To solve that problem, switlet house required a system that can monitor temperature and humidity, keep humidity around 80-90%, set active time (timer) for outside swiftlet sound caller, adjust the volume of swiftlet sound caller and perform monitoring visually without get in to swiftlet house. IoT (Internet of Things) is part of solution for all devices can work automatically and can monitor easily.

This IoT based swiftlet house monitoring system can monitor temperature and humidity, keep the ideal humidity range from 80-90%, set timer for outside swiftlet caller sound at desired time, adjust the volume of swiftlet sound, and monitor condition inside swiftlet building visually. This system is expected to facilitate swiftlet farmers to monitor the swiftlet house with more easily and precisely in handling.

Keywords : IoT, Kelembapan, Mikrokontroler, Suhu, Walet

1. INTRODUCTION

Swiftlet house is a place of switlet breeds that can be identified with a cage for livestock. It's called swiftlet house because in general house swiftlet is a residence and suddenly inhabited swiftlet, although the actual house swiftlet can be a new building built specifically for swiflet breeds to get a nest. One example of a house that is used as a house swiftlet belongs to Mr. Sayuti who was in Kp. Solor Kidul, Margagiri Village, Bojonegara District, Serang-Banten. Swiftlet nest prices in Serang regency for the highest quality ie in the form of a bowl that is ranged from Rp. 6,240,000, - up to 12,000,000, - per Kg [1].

From the interviews conducted to Mr. Sayuti owners swiftlet house. 1996 is the beginning of Mr. Sayuti plunge into cultivation swiftlet is when one of the rooms in his house entered by Bird Sriti and breed. Bird Sriti (Collocalia Esculenta) and walet (Collocalia fuci-phaga) of his body shape look similar [2]. The difference between the two is from the resulting nest, the sriti mengashilkan nest mixed with impurities such as pine leaves while the swiftlet will produce a nest that is formed entirely of saliva. Because swiftlet promises greater income than sriti, efforts to swiftlet nest and breed in swiftlet house done. The most common attempt to do this is eggshell, which is the eggs of Sriti (Collocalia Esculenta) with walet egg (Collocalia fuci-phaga).

In 2010, Mr. Sayuti used a swiftlet calling machine to play swiftlet sound. The sound of the swiftlet call consists of 2 kinds of sound, namely the outer voice and the inner calling voice. This method is powerful enough to lure swiftlet to enter the house swiftlet. Once one day the owner of the swiftlet house forgot to turn on the swiftlet calling machine, the swiftlet that previously swirled before swiftlet around the house becomes quiet. This happens because the swiftlet is a bird that lives berkoloni, so if swiftlets feel no colony then swiftlet-swiftlet will go to a place that already has a swiftlet colony that crowded.

The next problem to keep in mind is to keep the environment or home environment swiftlet to have temperatures ranging from 26-30oC and air humidity between 80-90% [3]. This is done so that the swiftlet feel at home in the natural environment and breeding. If the temperature and humidity are not ideal then the swiftlet will move to another place that in the end the population in the house swiftlet does not increase will even disappear. One effort to lower the temperature is to make ventilation holes, but this effort can reduce the humidity. To increase the humidity is to put a lot of tubs containing water. All these efforts are done without being monitored, not even using a thermohygrometer in order to know for sure the temperature and humidity inside the wale house.

Limitations of time checking the circumstances of the house swiftlet that requires owners out of the house swiftlet becomes a problem in itself. This is because the swiftlet will feel disturbed by the presence of humans. A very advisable time to enter the swiftlet house is at night when the swiftlet is resting. If the things that are not recommended to be done in the walet will be stressful and will leave the swiftlet house.

Based on the problems faced is required a system that can accommodate the need for monitoring and controlling the temperature in the house swiftlet, moisture house swiftlet and swiftlet sound volume. Therefore, with the concept of IoT (Internet of Thing) researchers interested in conducting research entitled "**DEVELOPMENT OF SWIFTLET HOUSE MONITORING SYSTEM BASED ON IOT**".

2.1 Theoretical basisRumah Walet

Swiftlet House is a building, either natural or man-made, used by butter swiftlet to shelter and breed. House walet has 3 sense, namely primitive swiftlet house, traditional swiftlet house and modern swiftlet house [3]. Swiftlet birds like to live colonized in the house of his favorite home. Swiftlet birds also have the instinct to go home (Homing Instinct) which keeps him always in the same house, unless his security is disturbed. Here is a type of swiftlet house::

1. **Primitive Swiftlet House**

   In the early days, before there were buildings of human civilization, swiftlet birds occupy certain natural caves for shelter and breed[3].

2. **Traditional Swiftlet House**

   Human civilization influences the behavior of animals, including swiftlets. Swiftlets sometimes choose man-made homes to live in, for example ancient houses, both uninhabited and still inhabited by humans. This traditional swiftlet house is generally left unattended without any maintenance process or repairs, for fear the swiftlet that lives in it will feel disturbed and move to another place [3].

3. **Modern**

   Modern swallow house built with a special way and purpose for swallow bird populated. This modern swallow house can be a new building, a complete reshuffle of a seriti house, or a quality improvement of a traditional swallow house whose conditions inside (micro habitat) are adapted to the requirements of the room needed by swallows to reside, ie as follows [3].

2.2 IoT (*Internet of Things*)

The last four decades after the discovery of the internet by the ARPANET, the term internet refers to a wide range of superbly built applications and protocols and interconnected computer networks serving billions of users worldwide in 7 days 24 hours [5]. We are really entering an era where communication exists everywhere and connectivity is not just a delusion and a difficult thing. Furthermore the focus is enhanced towards the seamless integration between humans with the equipment to unify the physical realm with a manmade virtual environment, creating the so-called Internet of Things (IoT).

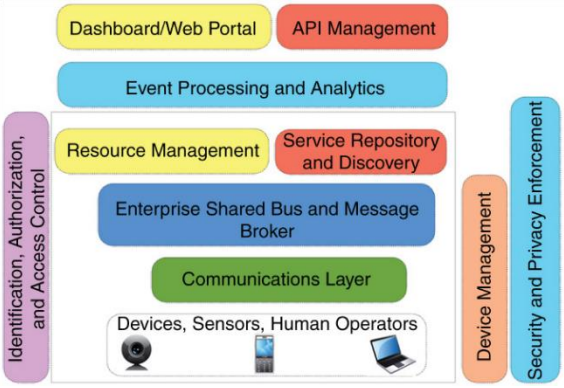


Figure 1. IoT Architecture

2.3 Web Service

Web service is a data set application (database), software (software) or part of software that can be accessed remotely by various devices with a certain intermediate [6]. In general, web services can be identified using URLs such as web only in general. But what distinguishes web service with the web in general is the interaction provided by the web service. Unlike web URLs in general, web service URLs only contain a collection of useful information, commands, configurations or syntaxes that builds certain functions of the application.

2.4 Banana Pi

Banana Pi is a set of single-sized, credit card-sized single board computers for software and hardware development in school software learning such as Scratch [7]. Its hardware design is influenced by Raspberry Pi in 2013. This product is manufactured by Chinese company Shenzhen SINOVOIP Co., Ltd.

Banana Pi software is compatible with Raspberry Pi board. Banana Pi can also run NetBSD, Android, Ubuntu, Debian, Arch Linux, Raspbian operating systems, even though the CPU complies with the requirements of the Debian armff port. Banan Pi uses Allwinner SoC (system on chip) and therefore is mostly covered by linux-sunxi port. Banana Pi is an open source hardware and software platform designed to help bananapi.org and banana-pi.org [7].



Figure 2 Banana Pi M1

The following is the specification of a single board computer from Banana Pi M1.

Table 1 Banana Pi Specification

CPU	A20 ARM Cortex -A7 Dual-Core
GPU	ARM Mali 400 MP2; Complies with OpenGL ES 2.0/1.1
Memory	1GB DDR3
Network	10/100/1000 Ethernet 8P8C (1000BASE-T)
Video Input	A CSI input connector allows for the connection of a designed camera module
Video Outputs	HDMI, CVBS, LVDS/RGB
Audio Outputs	3.5mm jack and HDMI
Power Source	5 volts DC via Micro USB or GPIO
USB 2.0 ports	2 (direct from Allwinner A20 chip)
GPIO	GPIO, UART, I2C BUS, SPI BUS, WITH TWO CHIP SELECTS, CAN bus, ADC, PWM, +3.3V, +5V, GND
LED	Power Key & 8P8C
Storage	SATA 2.0,

2. Analisis dan Perancangan

3.1 Communication

Communication is the decomposition stage of what is obtained from the research to identify and evaluate the problems, opportunities, constraints and expected needs so that proposed improvements can be proposed.

3.1.1 Problem analysis

The problems found in the research of the utilization of Banana Pi for the construction of monitoring system and control of home swallow web environment is as follows:

1. Swallow calling machine at home swallow belonging to Mr Sayuti still use manual way to adjust the volume of calling. The owner must rotate the volume knob every morning around 6:00 pm to turn on the outside and evening calling sounds at 18:00 pm to turn off the calling sound. Sometimes the owner forgot or did not have time to adjust the volume at that time.
2. Mr. Sayuti's swallow house is not equipped with tools to measure the temperature and humidity inside the swallow house without having to enter the swallow house. The effort to improve the humidity is to keep the tub full of water. Make ventilation holes with paralon pipes and elbow joints to lower the temperature. Such efforts can not be regulated because of relying on the forces of nature. The use of tools such as thermohygrometer to determine the level of humidity and temperature is not possible because the tool can only measure the temperature and humidity around it which means the owner must be in and out to make the measurement.
3. To monitor the condition or development of swallow house visually, the owner must go to swallow house. Opportunity to monitor visually is limited because to see the number of swallow stay as an indication of increasing swallow population, the owner must go to see directly.

When the swallow colony is resting at night. If forced to often see at night the feared swallow colony will strest because swallows are very sensitive to interference.

3.1.2 Analysis of Current System

System analysis is the stage that gives an overview of the current system. This analysis aims to provide a more detailed description of how the system works. The focus of this research is the sound control procedure, the effort to increase humidity and decrease the temperature and monitoring the house swallow.

3.1.2.1 Procedures Turn On and Turn Off Outside Calling Voices

The following are the steps performed in this procedure:

1. Swallow house owners will be in the morning will see the clock.
2. If the clock has shown at 06.00 WIB then the owner will turn on the outside calling sound by way to switch to on.
3. If the clock shows at 06.00 hrs then the owner will turn off the loud calling sound by shifting the toggle switch to the off position.

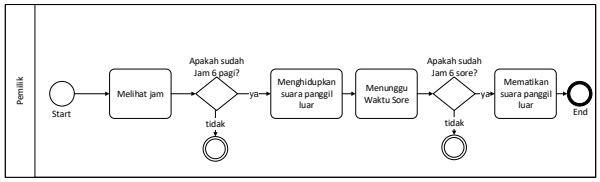


Figure 3 Procedures Turn On and Turn Off Outside Calling Voices

3.1.2.2 Procedure to Set Swiftlet Voice Sound Volume

The following are the steps performed in this procedure:

1. The owner entered into the swallow house to listen to swallow volume inside the swallow house.
2. The assistant is in charge of turning the volume knob for the sound of the call in accordance with the swiftlet owner's direction. If the swallow sound is less, the owner will notify the assistant will turn the volume knob in the direction of winding by clockwise. If it is too loud, the assistant will turn the knob clockwise.
3. The owner came out of the swallow house and positioned around the swiftlet entrance where the tweeter is located.
4. The assistant will do the same with step 2, only that is played is the volume knob of the outer calling.

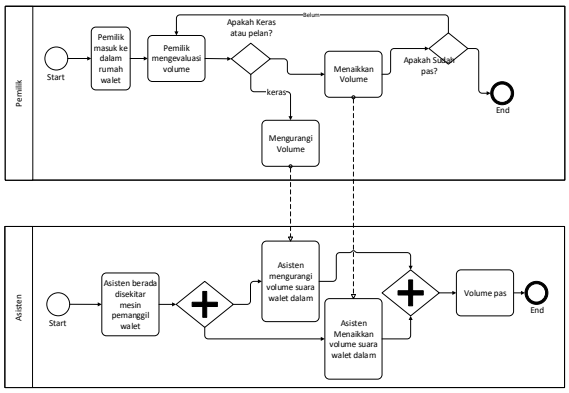


Figure 4 Procedure to Set Swallow Voice Sound Volume

3.1.2.3 Procedure to Maintain Humidity of Swallow House

The following are the steps performed in this procedure:

1. Owners prepare a large enough tub or pool to hold water.
2. The tubs are filled with water and allowed to evaporate on their own.
3. Once a month the owner checks the availability of water.

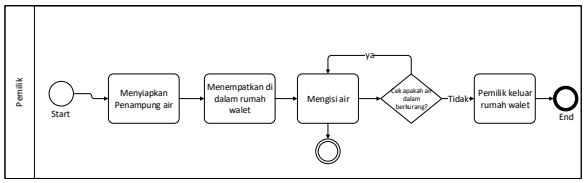


Figure 5 Procedure to Maintain Humidity of Swiftlet House

3.1.2.4 Prosedur Memantau Keadaan atau Perkembangan Rumah Walet

The following are the steps performed in this procedure:

1. Owners enter the house swallow to check the inside.
2. The owner checks whether there is a hollowed-out nest that signifies being gnawed by cockroaches or lizards.
3. The owner estimates the number of population to be known whether there is an increase in the number of swallows in the following month.
4. Owner out of swiftlet house, to check the outside.
5. The owner checks the swallow entrance hole is obstructed by tree branches and other objects that can block. If any owner needs to clean it up.

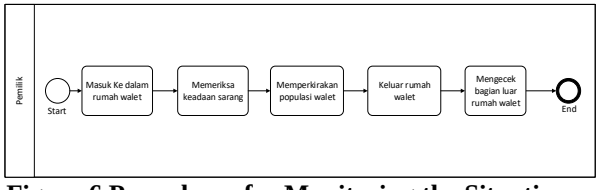


Figure 6 Procedures for Monitoring the Situation or Development of a Swallow House

3.1.3 Non Functional Needs Analysis

Non-functional requirements analysis is performed to generate details about the things the System is doing when it is implemented. The several parts included in Non Functional needs analysis are Hardware Requirement Analysis, Software Requirement Analysis and User Analysis.

Table 2 Minimum Hardware Requirement Analysis

No	Hardware	Specification
1	Processor	1,5 Ghz
2	Monitor	Resolution 1366 x 768 pixel
3	Memory	RAM 1 GB
4	Hardisk	Free Space 10 GB
5	VGA	256 MB
6	Mouse	Generic
7	Keyboard	Generic

3.1.4 User Needs Analysis

User Analysis is a provision of users who can operate or run an IoT based swallow home monitoring system. Here are the required user terms:

User	Task	Access Rights
Owner	- Set the time for the swallow sound to die or on. - Monitor home swallow environment. - Monitor the development of swallow house.	- Change the scheduling time. - Getting information on the temperature and humidity of swallow house and temperature regulator and humidity level. - Can see the situation / development of swiftlet visually through CCTV.

3.2 Quick Plan

At this stage is done system design prototype. The prototype created is tailored to a predefined system of problems faced by swallow owners.

3.2.1 System Architecture Analysis

System flow from home based IoT swallow monitoring system built by utilizing Banana Pi M1 as mini PC as well as microcontroller. This may be because Banana Pi M1 has a GPIO header that is controlled by C and Python programming languages. Overview of system architecture can be seen in figure 7.

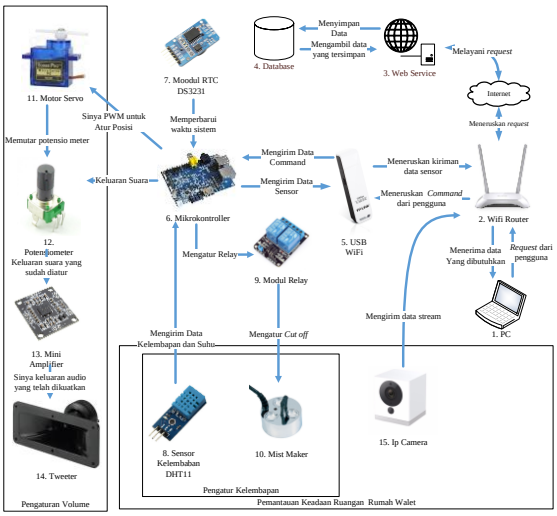


Figure 7 Swallow House Monitoring System Architecture

3.2.2 Data Communication Analysis

Analysis of data communication is a stage that analyzes how data can be transmitted so that communication between system parts can run properly. Data communication itself is concerned with the transmission of electronic data transmission system of a terminal computer terminal terminal of another computer. The data in question is an electronic signal generated by a data source that can be captured and sent to the receiving terminal**.**

The main elements of data communication systems have 3 main parts of the system. The following is an explanation of the three main parts of the system:

1. **Data Source**

Data sources are part of the system that serves as a data provider and also as a data sender. The data source available on this system can be described as follows.

a. RTC DS3231 Module

The DS3231 RTC module is used as the timing source. This module works the first time the system is run and will take time on the microcontroller.

b. DHT-11 Sensor

The DHT-11 sensor is a temperature and humidity sensor. This sensor is used as a source of temperature and humidity data. It has 3 pins that work each 2 pins as power supply and 1 pin for sending data signal connected to GPIO pin. Using scripts in Python.

c. IP Camera

The IP camera used here is Xiomi Xiaofang. IP camera has a maximum resolution of 1920 x 1800 pixels. But to suppress the use of bandwidth resolution is lowered to 800 x 480 pixels. The protocol for transmitting video setreaming using RTSP.

d. Mikrokontroler

Microcontroller used is Banan Pi M1 which also functions as a mini pc. Microcontroller is the control center that connects the module used. Microcontroller installed libary called urllib serves as a kind of parsing API so that the data obtained is the required data.

e. Desktop Computer

Desktop Computer or often known as a PC included into the data source because the user can input one value into the system via the web. The input data can be seen on the description of system architecture.

2. Transmission Media

a. USB WiFi

USB WiFi Which is used is TL-WN727. This tool serves as a liaison between the microcontroller with WiFi router.

b. WiFi *Router*

The WiFi router used is Totolink N200RE. This device is enabled as a hotspot for connected devices to access the internet. The main purpose of the internet is to access the web service.

3. Data Receiver

The data receiver is a device that receives data or information. The devices that receive the data are as follows:

a. Desktop Computer

Desktop computer or PC can be included into the data receiver on this system because the PC receives data in the form of temperature and humidity data and video stream premises opens web through browser....

b. Microcontroller

In the swallow house monitoring system, in addition to data sources, microcontrollers are also included into the data receiver because the microcontroller gets data from user input.

c.Relay

Modul relay merupakan modul yang berfungsi seperti sakelar, hanya saja bekerja secara elektronik. Modul relay termasuk ke dalam penerima data karena relay menerima sinyal *high* ataupun *low* yang didapat dari pin GPIO pada mitrkontroler.

d. Servo Motor

In the data communication analysis section will also explain how the monitoring system homes swallow work. In addition, will also explain the tools to be used.

3.2.3 Analisis Web System Work AnalysisWeb

The web is built with the Laravel framework whose primary language is PHP. The Laravel framework was chosen because it could meet the need for the construction of an IoT based swallow monitoring system.

3.2.3.1 Statistics of Temperature and Humidity

Statistics of temperature and humidity data are data that is processed from log data temperature and humidity to mean temperature and humidity and temperature statistic diagrams and humidity.

3.2.3.2 Log Data Temperature And Humidity

Log temperature and humidity data is log data obtained from DHT11 sensor recorded every 10 minutes. The units used in temperature measurement are celsius and for humidity is the relative humidity of air in the form of percent (%).

3.2.3.3 Humidity Settings

The humidity setting is the menu used to set targets for desired moisture levels. Where if the clarity is read under the target then mistmaker will continue to work until the humidity level reaches the target. The input range for humidity setting is in the range of 0 to 100.

3.2.3.4 Timer Setting

Timer setting is the menu used to input the outer calling-out time. In addition, on this menu also serves to menginputkan when the active voice dial outside. Input value of hours, minutes and seconds. The input clock value range is 00 to 23, minutes are 00 to 59 and seconds 00 through 59.

3.2.3.5 Volume

Volume is the menu used to adjust the volume of the swallow sound. The volume set is the volume of the outer call and the internal sound. The range of input values is from 0 to 100.

3.2.3.6 Streaming

Streaming is a menu used to stream from IP Camera used, in this case is Xiaomi Xiaofang. The protocol used to transmit audio video from the IP camera is RTSP. Basically RTSP can not be directly played on web browser, therefore needed a plugin, plugin used is VXG Media Player. The resolution used is 640x480 pixels.

3.3 Modelling Quick Design

At this stage, modeling system prototype is adapted to system design.

3.3.1 Functional Needs Analysis

3.3.1.1 Use Case Diagram

Use case diagrams are diagrams that show the functionality of a system or class and how the system interacts with the outside world and describes the system functionally visible to the user. From the identification of the actors involved above then Use Case Diagram can be seen in Figure 8.

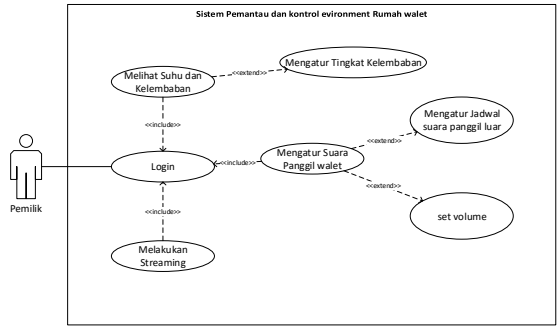


Figure 8 Use Case Diagram

3.3.2 Database Design

Database design is the stage to map the conceptual model to the database model that will be used. Database design is divided into two namely the relation scheme and table structure design.

3.3.3 Relationship scheme

Relation scheme is a series of relationships between several tables in the database system. Explanation of the database circuit in this system can be seen in the picture below.

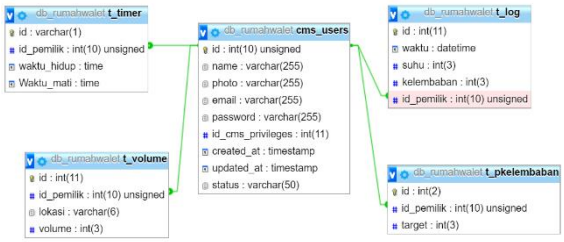


Figure 9 Relationship scheme

3. Implementation and Testing

4.1 Construction of Prototype

After the design stage dikalukan, then the next stage is the implementation stage of the design. At this stage the system is built based on the results of analysis, either in the form of software or hardware.

4.1.1. Hardware Implementation

- Computer Hardware

Tabel 3 Hardware for System Implementation

No.	Hardware	Specification
1	Processor	3.2 GHz
2	Memory	4 GB
3	*Harddisk*	500 GB
4	VGA	1 GB
5	Monitor	14” dengan resolusi 1336 x 768 pixel
6	Mouse	*Optical Mouse*
7	Keyboard	*Standard*
8	Interface Jaringan	*Onboard* LAN (Koneksi jaringan menggunakan kabel)

- IoT Hardware

Table 4 IoT Hardware for Siystem Implementation

No.	Hardware	Description
1	Microcontroller	Banana Pi M1
2	Storage Media	Micro SD 32 GB
3	Wifi Adapter	TP-Link TL-WN727N
4	Humidity and temp Sensor	DHT - 11
5	RTC Module	DS3231 I2C
6	Aktuator for rotating *potensiometer*	*Servo Motor* SG90
7	Relay Module	2 relay module
8	Mini *Amplifier*	PAM 8610
9	Humidifier	Ultrasonik *Mistmaker*
10	Speaker	*Piezo Tweeter*
11	IP Camera	Xiaomi Xiaofang

4.1.2. Software Implementation

- Software Implementation on Computer

Table 5 Software Implementation on Computer

No	Perangkat Lunak	Spesifikasi
1	Operating System	Windows 10
2	Database Server	MySQL
3	Code Editor	Atom
4	Browser	Google Chrome
5	Plugin Browser	VXG Media Player

- Software Implemtation IoT

Tabel 6 Software Implementation on IoT

No	Software	Spesification
1	Operating System	Raspberian Jessie
2	Programming Language	Python
3	Music Player	Clementine
4	Browser	Google Chrome
5	Plugin Browser	VXG Media Player

4.1.2 Overall System Testing

The entire system test is intended to test the work of sensors and actuators that have been integrated with the web as a control. Web as a control here means that the web is used to input the required parameters and the interface that provides surveillance facilities. The purpose of this test is to find out whether the system is working properly.

a. Temperature and Humidity Log Testing

This temperature and humidity log test is conducted to see if the system can monitor the temperature and humidity inside the swallow house. Here are the results of the temperature and humidity logs performed on July 30, 2017.

Table 7 Result of Measurement of Temperature and Humidity

Time	Temp (°C)	Humidity (%)
30/07/2017 15.43	28	90
30/07/2017 15.42	28	90
30/07/2017 15.41	28	90
30/07/2017 15.40	28	88
30/07/2017 15.40	28	90
30/07/2017 15.40	28	88
30/07/2017 15.40	28	87
30/07/2017 15.40	28	90
30/07/2017 15.40	28	88
30/07/2017 15.40	28	87

It turns out the humidity in the house swallow belonging to Mr Sayuti is high. Up to 90% which is the limit of DHT-11 sensor measurement capability. From the tests conducted it can be concluded that the built system can perform log temperature and humidity.

b. Result Set Humdity Testing

Testing to regulate the moisture is a test conducted to mengatahui how precise time active mistmaker in keeping the humidity in accordance with the target. However, given the high humidity of the air that reaches 90% in Mr. Sayuti's swallow house so it is difficult to perform direct testing. Therefore, a prototype is made to perform the test in regulating moisture. The created prototype has a dimension of 49.5 x 26 x 33 cm.

Tabel 8 Result Set Humdity Testing

Testing	Target	First Humidity	Last Humidity	Time Is Needed
1	80	64	82	6
2	85	65	86	9
3	90	64	89	13

From the test results set the humidity can be concluded that the system can set the humidity sesuati target specified. And it takes 6-13 seconds to increase the humidity of walet house spaces that have dimensions of 49.5 x 26 x 33 cm or 42,471 liters.

c. Timer External Sound Caller Testing

An external call timer test is a test performed to determine the timeliness that has been set for an out-of-date or dead-call vocal timing over the actual time. Input time is done through the antamuka that exist in the web system. Test results can be seen in the following table.

Tabel 9 Result of Timer Testing

Try Count	Condition Target	Input Timer	Atual Time	Condtion
1	On	09:45:00	09:45:10	Light indicator is on
	off	09:47:00	19:4:13	Light indicator is off
2	On	09:55:00	09:55:12	Light indicator is on
	Off	09:57:00	09:57:11	Light indicator is off
3	On	10:15:00	10:15:13	Light indicator is on
	Off	10:15:00	10:15:14	Light indicator is off

From the test results can be concluded that the system can adjust the swallow sound schedule even though there is a delay between 10-14 seconds before the relay reacts when the time to turn on or off.

d. Swallow Sound Volume Settings Testing

Swiftlet volume control test is a test conducted to determine the accuracy of volume settings. The volume adjustment in this system is done by potentiometer rotated by the servo motor and its volume value is inserted through the interface of the web system. Therefore, the test is performed by measuring the rotation angle by the servo motor, where the series servo motor SG-90 has a rotation radius of 120o and the input volume ranges from 0-100%. Rotary angle on the servo motor using a protractor. To calculate the correct angle of the volume value

$$Sudut\ putar\ seharsnya = \frac{volume}{100} \text{x} 120$$

Test results can be seen in the following table.

Table 10 Swallow Sound Volume Settings Testing

Try Count	Volume Pisition	Input Volume (%)	Supposed angle degree (^{0})	Measurement Result Derajat (^{0})
1	Internal Sound	25	30	32
	External Sound	25	30	27
2	Internal Sound	50	60	59
	External Sound	50	60	62
3	Internal Sound	100	160	155
	External Sound	100	160	158

From testing the swallow volume setting can be concluded that the system can adjust the swallow volume even though the rotation performed by the servo motor is not so precise because of the difference of 1o-5o from the point that it should.

e. Streaming Testing

Testing streaming is testing done to find out how much delay. Delay is meant here is delayed update frame so there is a pause between the actual state of being dijdai with circumstances that seem in the video. To find out how much delay, observation of an object that was previously silent, then moved in front of the IP camera is active. The delay time starts to be calculated as the object is moved until the video stream from the IP camera displays the event and uses the stopwatch to calculate the delay time. Here is a table of test results.

Tabel 11 Result of Streaming Testing

Try Count	Kondisi	*Delay* (Second)
1	Bright	3,3
	Dark (*Night Vision*)	3,4
2	Bright	3.5
	Dark (*Night Vision*)	3,1
3	Bright	3,2
	Dark (*Night Vision*)	4,5

From the results of streaming tests can be concluded that the system can occur delay when streaming for 3-4 seconds.

4. Conclution and Suggestion

4.1 Conclutions

The conclusions of the discussion and testing on the Development of Swift House Control System are as follows:

1. This IoT based swallow monitoring system can adjust the working time of the outer calling voice, ie by entering when the time of inactive and active time twiter. So there is no forgetfulness to turn off or turn on the outside calling sound.
2. This IoT based swallow monitoring system can monitor temperature and humidity. Statistics are average temperature and humidity. In addition to this system also diagram the average line of humidity and temperature from time to time to see the fluctuations that occur to be more easily legible. And can set the target humidity level with the use of mist maker.
3. This IoT-based swallow home monitoring system is equipped with IP Camera streaming feature to meet the need to visually monitor the circumstances inside the swallow house, so that the owner does not need to go in and out of the house swallow house to check.

4.2 Suggestion

This system can be expanded to a wider range of unrestricted uses only on scrambling home surveys alone. The following suggestions can be given for the development of a further IoT based swallow monitoring system:

1. For temperature and humidity sensors can use DHT-22 for more accurate measurement results. DHT-22 can measure relative humidity from 0-100% which is only a maximum of 90% to get good accuracy.
2. The current system is used only for specific use by 1 house swallow only. The future is expected to be developed for the needs of a swallow house consultant used for monitoring and control of some of the swallow houses he or she handles.
3. Web service if possible can be embedded in the microcontroller will be better.
4. It is recommended to change the data exchange method not to use urllib library or to keep using urllib but with error handling to minimize the cessation of the system because when one request failed to be obtained due to a disconnected network or server that rejected request that repeatedly.

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