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KEMENTERIAN PENDIDIKAN TINGGI



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Animal Shed Monitoring System

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ABSTRACT

Livestock kept in enclosed sheds are sensitive to shed temperature and humidity, as these environmental factors affect their health and development. Thus, an environmental monitoring system can be designed to monitor the internal environment of an animal shed. This innovation aims to improve animal welfare by integrating technology into farming practice. In this project, we have successfully designed a smart monitoring system named AnimalGuard that can function to measure temperature and humidity inside a shed. The methods applied are the use of IoT (Internet of Things), Arduino, sensors and a low-code programming language to create a system that collects and collates data from the monitoring system for farmers' direct viewing. The concepts applied are heat transfer, light-dependent resistance and thermodynamics. To gather preliminary data, we visited a local chicken farm to record temperature and light intensity in the shed and observe chicken behaviour before designing the prototype. The prototype was later tested using a hairdryer to simulate temperature increases. It successfully detected temperature changes when heat was applied and triggered automated alerts via Telegram. The AnimalGuard system provides a cost-effective, accessible monitoring solution for smallholders in Malaysia and tropical countries, with the market being smart farming in rural areas. Hence, the livestock monitoring kit is aimed to be priced under RM200 and sold via e-commerce or agricultural departments.

Keywords: livestock, monitoring, environment, sensors, IoT (Internet of Things)

1. INTRODUCTION

Livestock farming is a major source of income for smallholders in Malaysia. However, many smallholder farmers still rely on manual checks of shed conditions, which is time-consuming and inefficient. They cannot access existing environmental monitoring systems due to high costs.

Therefore, the objectives of this project are:

1. To create a system that monitors shed temperature and light intensity using sensors.
2. To design an affordable and easy-to-use smart monitoring system for smallholders.
3. To demonstrate the application of basic physics (heat transfer, thermodynamics, light-dependent resistance) and electronics in agriculture.

Research shows that sub-optimal housing conditions, including poor air quality and thermal stress, compromise animal health and welfare (Banhazi et al., 2008). Researchers have developed user-friendly and low-cost environmental monitoring systems for livestock buildings (Banhazi, 2009; Clements et al., 2011). The Internet of Things (IoT) has enabled real-time data collection and remote alerts for animal tracking and environmental monitoring (Saini, 2024; Sohraby et al., 2007). This project builds on these foundations by developing an affordable, IoT-based monitoring solution tailored specifically for smallholders.

The methods included a preliminary farm visit to collect baseline temperature and light data, observation of chicken behaviour, followed by the creation and testing of the prototype using a hairdryer to simulate heat increases.

The main results show that the system successfully detects temperature changes above a preset threshold (32 °C) and sends alert messages via Telegram. The prototype responds within 15 seconds and logs data into graphs.

2. METHODOLOGY

2.1 Research Design

The system will be attached to the inner wall of the livestock shed. The sensors will detect air humidity and temperature. Arduino will process the sensor signals. Data will be sent to Node RED, organised into graphs and tables. Information will be kept in Node-RED and accessible to the farmer on demand. If the temperature exceeds the threshold, Arduino will then process code and send alert messages to farmers via Telegram Bot.

2.2 Sampling Procedure

A purposive sampling method was used for this project, as the main goal was to observe and understand the environmental conditions of a typical small-scale livestock farm. This method was chosen because it allowed us to select a specific site to conduct sampling and tests. In this case, a small neighbourhood chicken farm.

The participant in this study was a local chicken farmer who voluntarily agreed to allow observations of his farm. The farmer was selected because his setup represented common conditions in small-scale livestock farming, which often rely on natural ventilation and minimal automation. The chicken shed provided an accessible environment in terms of temperature fluctuation, humidity, and light exposure, making it suitable for preliminary testing and observation.

2.3 Materials or Instruments

In this project, the components and platforms used are Arduino UNO (microcontroller), DHT11 (temperature sensor), breadboard, jumper wires, resistors, power supply, Telegram (messaging app) and Node RED.

2.4 Procedure

We visited a smallholder's chicken farm in Sitiawan to record temperature and light intensity readings at different times of the day (morning, afternoon and night) for a span of three days. The Arduino with DHT11 (temperature sensor) and LDR (light sensor) modules were temporarily installed inside the chicken shed to collect data for a short observation period.

During the site visit, notes were taken on the chickens' physical behaviour and environmental factors such as ventilation, sunlight exposure, and humidity. Sensor readings were recorded every few minutes and compared to the comfort range for livestock. These readings helped identify when environmental conditions became unsuitable, providing reference points for programming the AnimalGuard system's threshold values.

However, a few experimental manipulations were carried out:

1. Adjusting shed temperature: A stand fan was used to slightly decrease the temperature of the shed. The purpose was to test how accurately the temperature sensor detects a change in temperature.
2. Controlling light exposure: We dimmed and brightened randomised areas in the shed to test how LDR reacts to different lighting conditions.
3. Alert-response simulation: We artificially triggered alert conditions. For example, warming the temperature sensor with a heat lamp to observe whether the system responds correctly.

3. RESULTS AND DISCUSSION

Table 1. Animal Behaviour based on Temperature and Light Intensity throughout the Day

Time of the Day	Average Temperature (°C)	Average Light Intensity (lx)	Animal Behaviour
8:00 a.m.	26.3	820	Calm, resting
12:00 p.m.	34.7	260	Restless, moved to shade
2:00 p.m.	35.7	210	Signs of heat stress
7:00 p.m.	28.1	700	Calm, resting

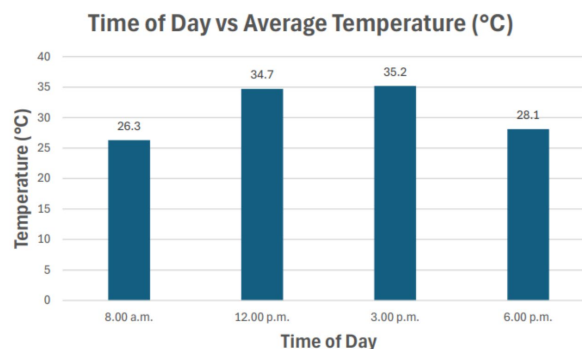


Figure 1. Bar Chart of Average Temperature depending on Time of Day

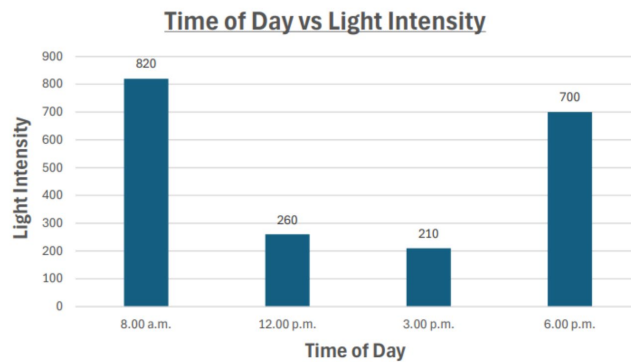


Figure 2. Bar Chart of Average Light Intensity depending on Time of Day

Analytical methods were applied to interpret the observed relationship between temperature and light. Observations of animal behaviour were also compared with sensor data to identify signs of heat stress during high-temperature periods. These analyses were used to determine suitable threshold values for activating the AnimalGuard alert system.

The readings show that at noon and in the afternoon, the temperature rose above 34°C, leading to visible discomfort among the chickens. This suggests a maximum comfort threshold of below 32°C for the alert system. The measurements of light intensity were ambiguous, depending on the time of day and location of the sensor. This served as a baseline for a system to alert farmers. Overall, the data collected has served as a foundation for the mechanism of our system.

4. CONCLUSION

In conclusion, the findings show that AnimalGuard can achieve the objectives of monitoring temperature and humidity, sending real-time alerts when the threshold (32 °C) is exceeded, and logging data on Telegram for farmer review. The prototype responds within 15 seconds and uses components costing under RM200. It has the commercial potential to be sold via e-commerce platforms or through agricultural departments. The target market is smallholders in Malaysia and other tropical countries, with a focus on smart farming in rural areas. With this low-cost system, the animal welfare of livestock can be improved.

Future recommendations are:

1. Adding a humidity sensor for more accurate heat stress assessment.
2. Testing the system in a real shed for at least one month.
3. Integrating an automated cooling fan or misting system as a feedback mechanism.
4. Developing a mobile app for better data visualisation.

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