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**Rancang Bangun Sistem Smart Cat Feeder Berbasis Internet of Things (IoT) Sebagai Pendukung Mitigasi
Risiko Feline Lower Urinary Tract Disease (FLUTD) pada Kucing**
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INTISARI

RANCANG BANGUN SISTEM *SMART CAT FEEDER* BERBASIS *INTERNET OF THINGS* (IOT) SEBAGAI PENDUKUNG MITIGASI RISIKO *FELINE LOWER URINARY TRACT DISEASE* (FLUTD) PADA KUCING

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Feline Lower Urinary Tract Disease (FLUTD) merupakan gangguan kesehatan yang umum terjadi pada kucing dan berkaitan erat dengan pola pemberian pakan yang tidak terkontrol serta minimnya pemantauan kondisi energi secara berkelanjutan. Penelitian ini bertujuan merancang dan mengimplementasikan sistem *Smart Cat Feeder* berbasis *Internet of Things* (IoT) bernama *PawfectCare* untuk mendukung mitigasi risiko FLUTD melalui otomatisasi pemberian pakan, pemantauan *real-time*, dan perhitungan kebutuhan energi berbasis profil biologis kucing. Sistem dibangun menggunakan dua unit ESP32 yang dilengkapi sensor *load cell* HX711 untuk mengukur berat pakan, sensor ultrasonik HC-SR04 untuk memantau stok pakan, motor *servo* MG90S sebagai mekanisme dispenser, dan layar OLED sebagai antarmuka lokal, yang terintegrasi dengan Firebase (Authentication, Realtime Database, dan Cloud Firestore) serta aplikasi web *PawfectCare* berbasis React dan TypeScript. Perhitungan kebutuhan energi harian menggunakan pendekatan *Resting Energy Requirement* (RER) dengan faktor koreksi berdasarkan usia, status reproduksi, jenis kelamin, *Body Condition Score* (BCS), dan tingkat aktivitas kucing. Pengujian sistem dilakukan melalui *black-box testing* terhadap fungsionalitas aplikasi web serta pengujian kuantitatif terhadap akurasi sensor, ketepatan dispenser pakan, dan waktu tanggap (*response time*) sistem. Hasil pengujian menunjukkan bahwa sensor berat memiliki nilai *Mean Absolute Percentage Error* (MAPE) sebesar 1,69% dengan tingkat akurasi 98,31% dan koefisien determinasi (R^2) sebesar 0,9924. Mekanisme dispenser pakan mampu mencapai berat target dengan toleransi ±1,5 gram, sedangkan rata-rata waktu tanggap sistem sebesar 28,16 detik. Berdasarkan hasil pengujian menggunakan Vercel Speed Insights, aplikasi web *PawfectCare* memperoleh *Real Experience Score* (RES) sebesar 93 pada platform *mobile* dan 91 pada platform *desktop*, yang keduanya termasuk dalam kategori *Great*. Selain itu, penerapan *Role-Based Access Control* (RBAC) memungkinkan pengelolaan hak akses antara peran *SUPER_ADMIN* dan *USER* secara aman. Secara keseluruhan, sistem *PawfectCare* mampu memberikan pengelolaan pakan dan energi kucing yang lebih terukur, terkontrol, dan terdokumentasi sebagai upaya mendukung pencegahan FLUTD.

Kata kunci: *Internet of Things, Smart Cat Feeder, Feline Lower Urinary Tract Disease, ESP32, Firebase*

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ABSTRACT

DESIGN AND DEVELOPMENT OF AN INTERNET OF THINGS (IOT)-BASED SMART CAT FEEDER SYSTEM AS A RISK MITIGATION SUPPORT TOOL FOR FELINE LOWER URINARY TRACT DISEASE (FLUTD) IN CATS

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Feline Lower Urinary Tract Disease (FLUTD) is a common health disorder in cats that is closely associated with uncontrolled feeding patterns and the lack of continuous nutritional monitoring. This study aims to design and implement an Internet of Things (IoT)-based Smart Cat Feeder system, named PawfectCare, to support FLUTD risk mitigation through automated feeding, real-time monitoring, and daily nutritional requirement calculations based on the biological profile of each cat. The system was developed using two ESP32 microcontrollers equipped with an HX711 load cell sensor to measure food weight, an HC-SR04 ultrasonic sensor to monitor food stock levels, an MG90S servo motor as the dispensing mechanism, and an OLED display as the local USER interface. The hardware is integrated with Firebase (Authentication, Realtime Database, and Cloud Firestore) and a PawfectCare web application developed using React and TypeScript. Daily nutritional requirements are calculated based on the Resting Energy Requirement (RER) method with correction factors for age, reproductive status, sex, Body Condition Score (BCS), and activity level. System evaluation was conducted through black-box testing of the web application functionality, along with quantitative testing of sensor accuracy, feed dispensing accuracy, and system response time. The experimental results show that the weight measurement sensor achieved a Mean Absolute Percentage Error (MAPE) of 1.69%, with an accuracy of 98.31% and a coefficient of determination (R^2) of 0.9924. The feed dispensing mechanism successfully achieved the target weight within a tolerance of ±1.5 grams, while the average system response time was 28.16 seconds. Performance evaluation using Vercel Speed Insights showed that the PawfectCare web application achieved a Real Experience Score (RES) of 93 on the mobile platform and 91 on the desktop platform, both classified as Great. Furthermore, the implementation of Role-Based Access Control (RBAC) enables secure access management between the SUPER_ADMIN and USER roles. Overall, the PawfectCare system provides a more measurable, controlled, and well-documented approach to cat feeding and nutritional management, thereby supporting FLUTD prevention.

Keywords: Internet of Things, Smart Cat Feeder, Feline Lower Urinary Tract Disease, ESP32, Firebase