UNIVERSITAS TELKOM PURWOKERTO | S1 TEKNIK TELEKOMUNIKASI

PORTFOLIO TUGAS AKHIR

SISTEM PENGUSIR HEWAN HAMA (OTTER) PADA PERIKANAN POKDAKAN MINA JAYA DENGAN NOTIFIKASI AKTIVASI VIA TELEGRAM

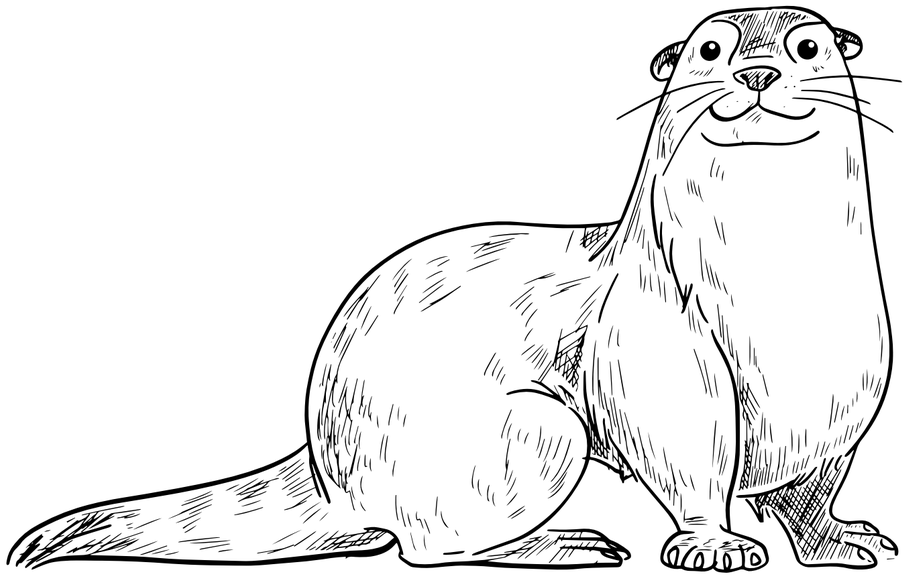
TELKOM UNIVERSITY

PEST ANIMAL REPELLENT SYSTEM (OTTER) IN MINA JAYA POKDAKAN FISHERIES WITH ACTIVATION NOTIFICATION VIA TELEGRAM

ZAKY TIFFANY LAZUARDY	21101109
MUHAMMAD RIZKY SUGIANTORO	21101060
IBNU ADITYA PAMUNGKAS	21101078

TELKOM UNIVERSITY PURWOKERTO

Faculty of Electrical Engineering - Bachelor of Telecomunication Engineering



CHAPTER 1
Introduction

Background of the Problem

- Decline in income due to a decrease in the number of fish that can be harvested.
- Increase in operational costs to replace lost fish and repair damaged infrastructure.
- Decrease in the competitiveness of the aquaculture industry due to rising production costs.
- Potential decline in investment interest in the aquaculture sector.

Formulation of the problem

1. How effective is the device in detecting disturbances using a gyroscope sensor to repel weasel pests?
2. How does the system perform in response to angle changes, and is the device effective in operation?
3. What is the shape of the ultrasonic wave generated in various testing scenarios?
4. How reliable is the Telegram notification system across different testing scenarios?

Telkom University

Objectives and Benefit

Casptone Design

Objectives

This garangan repellent device offers a practical, efficient solution to protect fish farms from attacks. It is simple, user-friendly, and affordable, making it ideal for small to medium-scale fish farmers.

Benefit

This tool supports investment in fish farming by offering reliable protection from external threats. It repels garangan without harming the fish, promoting sustainable aquaculture and reducing the need for constant supervision.

Scope of Problem

- Battery life is only around 12 hours and cannot operate for a full 24 hours.
- The main material is still acrylic, which is less resistant to cold weather, especially rain.
- The device can be carried away by currents as it floats without a support pole.
- The system cannot yet distinguish between garangan pests and other animals.

Telkom University

Casptone Design

Research Methods

Literature Review

Studied relevant technologies such as gyroscope sensors, ultrasonic waves, and Telegram notifications as the foundation for system design.

System Design

Designed the system architecture, pest detection workflow, and integration of key components like ESP32, MPU-6050, and ultrasonic buzzer.

Hardware & Implementation

Installed components on a floating platform, programmed the ESP32, and configured the system to operate automatically when detecting movement in the pond.

Testing & Data Analysis

Conducted quantitative testing to evaluate sensor response, ultrasonic effectiveness, and Telegram notification reliability.

CHAPTER 2

Literature Review and theorecital basis

Telkom University

Capstone Design

Literature Review

- Annisa et al. (2020) – Prototype of an IoT-based bird repellent system with hybrid power supply.
- Mohammad Iqbal et al. (2022) – Rice field rat repellent device using Arduino Uno and ultrasonic waves.
- Khoirudin Fathoni et al. (2024) – Development of an IoT-based bird repellent and automatic soil pH monitoring tool for Mangunsari farmer group.

Theoretical Basis

System Using Internet of Things

The system is connected to the internet, allowing real-time monitoring and notifications

Wireshark Network Monitoring

Wireshark is software used to analyze computer network activity, useful for network professionals, administrators, researchers, and network software developers.

Notifications using Telegram Bot

Telegram Bot API is used for notifications, enabling real-time monitoring of router status in the network.

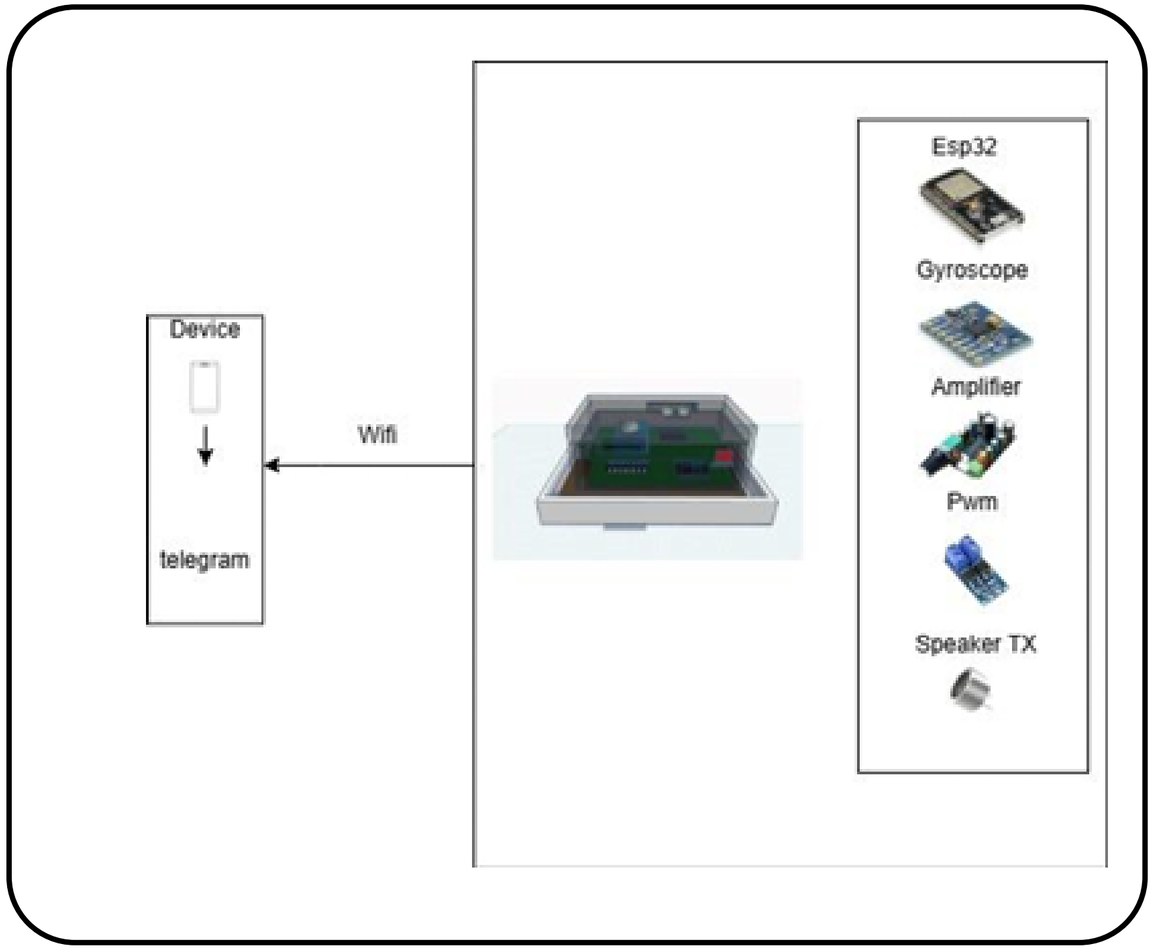
CHAPTER 3

Research Methodology and system Design

Telkom University

System Design

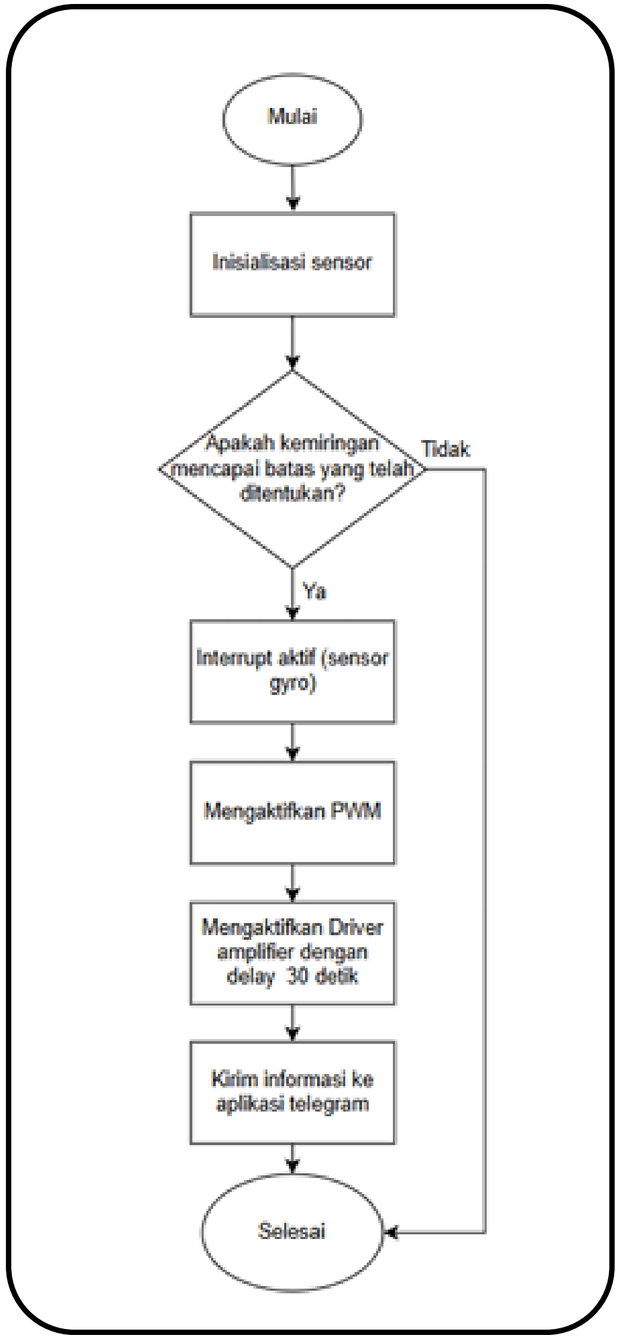
Capstone Design



The system uses WiFi to connect the ESP32 with Telegram for automatic pest repellent monitoring. The ESP32 processes gyroscope data to detect vibrations or movement, then activates the PWM module to generate ultrasonic waves, which are amplified and emitted through a speaker. Notifications are sent to the user's phone via Telegram.

Telkom University

Block Diagram



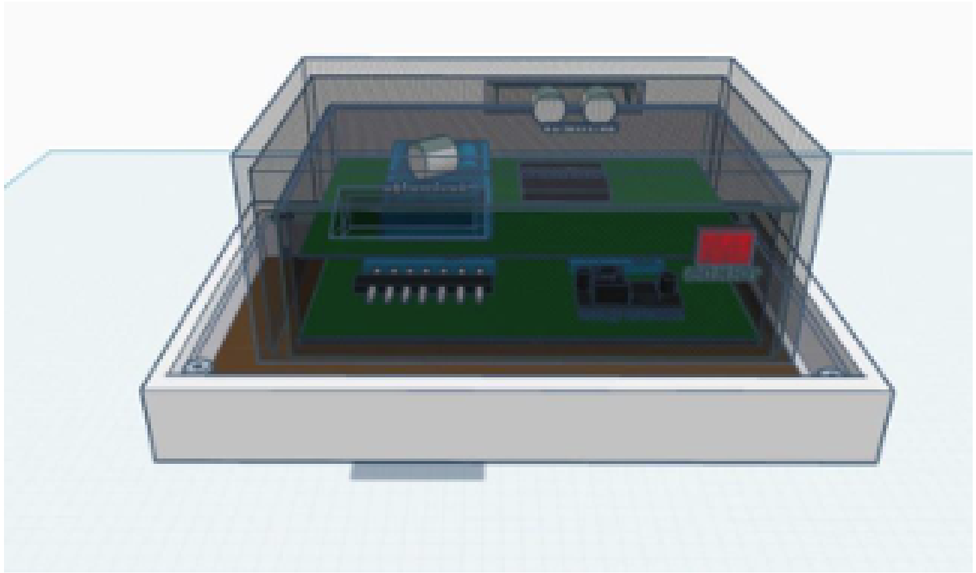
Capstone Design

The system uses a 3-axis gyroscope sensor to detect suspicious movements around the fish pond. Data from the sensor is processed by the ESP32 to activate the PWM module, which generates ultrasonic signals. These signals are amplified and transmitted through the TX speaker to repel weasel pests.

Telkom University

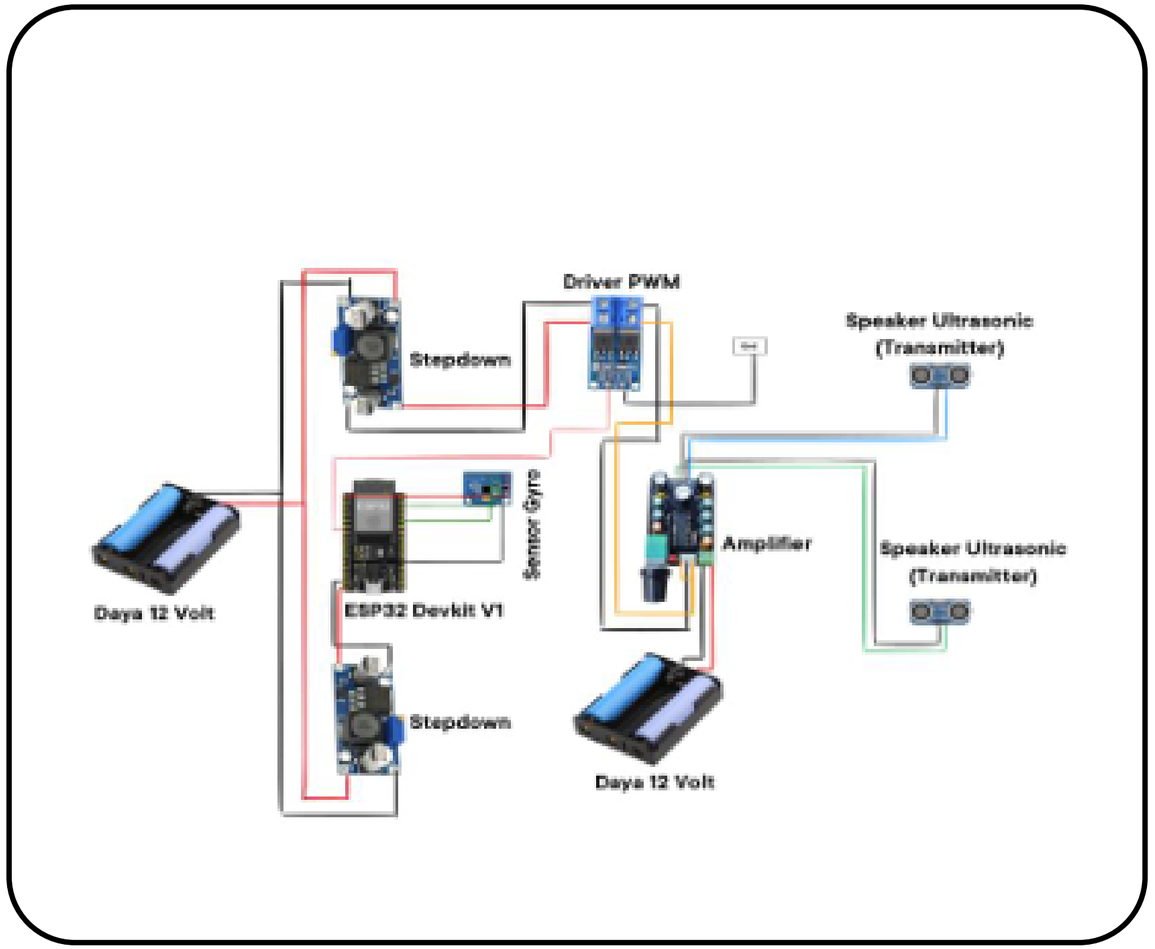
Capstone Design

System Hardware Design



The device uses styrofoam for buoyancy, with added pipes for stability in the pond. Electronic components are centrally mounted on acrylic and arranged to maintain balance and prevent gyroscope interference. The bottom is lined with aluminum to direct ultrasonic waves downward.

IoT Device System Design



The device consists of several key hardware components, including the ESP32 microcontroller, step-down voltage regulator, amplifier, 18650 lithium battery, and TX speaker. Each component plays an essential role in ensuring the system functions reliably and efficiently.

CHAPTER 4

Result Analysis

Tilt testing on gyroscope and frequency sensors Test Result

Nomor Pengujian	Sudut drajat	frekuensi yang dikeluarkan	Rata rata frekuensi yang dikeluarkan
Pengujian 1	2,5	20666 Hz	
Pengujian 2	3,0	20666 Hz	
Pengujian 3	3,5	20666 Hz	$\frac{Rata\ rata\ frekuensi}{20} = 21.816\ Hz$
Pengujian 4	4,0	20888 Hz	
Pengujian 5	4,5	20888 Hz	
Pengujian 6	5,0	20888 Hz	
Pengujian 7	5,5	21111 Hz	
Pengujian 8	6,0	21222 Hz	
Pengujian 9	6,5	22444 Hz	
Pengujian 10	7,0	21555 Hz	
Pengujian 11	7,5	21777 Hz	
Pengujian 12	8,0	21777 Hz	
Pengujian 13	8,5	21777 Hz	
Pengujian 14	9,0	22444 Hz	
Pengujian 15	9,5	22000 Hz	
Pengujian 16	10,0	22222 Hz	
Pengujian 17	10,5	22222 Hz	
Pengujian 18	11,0	22444 Hz	
Pengujian 19	11,5	22444 Hz	
Pengujian 20	12,0	26222 Hz	

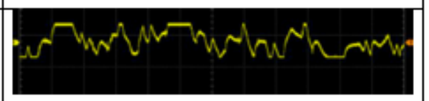
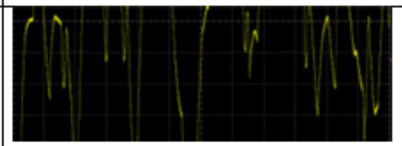
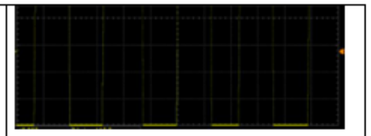
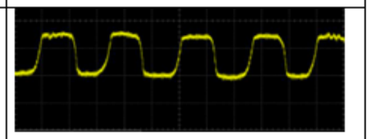
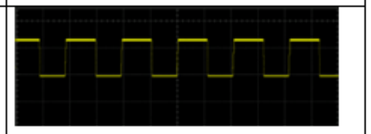
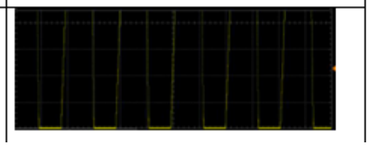
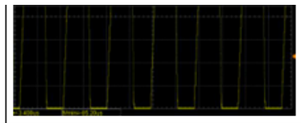
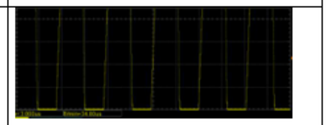
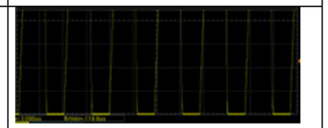
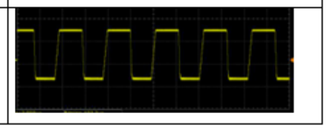
The device can float stably on water and detect slight tilts caused by waves using a gyroscope sensor. The greater the tilt, the higher the ultrasonic frequency produced averaging 21816 Hz and peaking at 26222 Hz at a 12° angle. These frequencies effectively repel pests without disturbing humans, indicating the system is responsive and adaptive to changes in water surface conditions.

Testing on wireshark application Test Result

Pengujian	*Throughput* (bits/s)	*Packet loss* (%)	Rata rata *delay* (ms)	Rata rata *jitter* (ms)
Pengujian 1	14,09k	7,8	79,231425	1,897974
Pengujian 2	5,989	10.49	172653464,5	980.162,5222
Pengujian 3	6.024	12,99	247962295,9	14.322,09738
Pengujian 4	15,46k	6.99	132.235.395	4265684,556
Pengujian 5	7.781k	12.3	233.302.200	13.611,51407
Pengujian 6	7253	12.68	243.0588.56,7	2762,176162
Pengujian 7	5580	12.37	235.748.236,9	-12404,18118
Pengujian 8	13k	8.4	200754806,7	-0,000000016233
Pengujian 9	5280	12.46	256158141,8	-23046,09929
Pengujian 10	9864	8.8	182.247.825,3	-0,000000014997 5
Pengujian 11	6129	8.29	247.812.098,9	1.501.100,486
Pengujian 12	5005	8.7	243544750,8	-79516845,9
Pengujian 13	4.956	8.7	159.455.243,2	-3431506,757
Pengujian 14	12k	8.3	202573064,2	-3640354,158
Pengujian 15	7441	9.9	217.012.492	-0,000000015155
Pengujian 16	11k	7,9	167749683,9	16751443,08
Pengujian 17	9614	5.29	181056839,6	-50063981,13
Pengujian 18	5030	4.89	260203403	-105600134,3
Pengujian 19	8838	8.5	171.693.994	-20127126,51
Pengujian 20	5084	13.2	299170763,1	20946643,08

Testing showed varied network performance. Results revealed fluctuating throughput, high packet loss, extreme delays, and unstable jitter. This indicates the system still needs improvements in timing accuracy and transmission stability before field deployment.

PWM testing on an oscilloscope Test Result

Pengujian	Frekuensi (kHz)	Gelombang frekuensi
Pengujian 1	23.8	
Pengujian 2	34.7	
Pengujian 3	29.4	
Pengujian 4	19.5	
Pengujian 5	19.7	
Pengujian 6	24.0	
Pengujian 7	24.0	
Pengujian 8	26.6	
Pengujian 9	24.3	
Pengujian 10	26.0	
Pengujian 11	23.6	

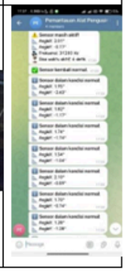
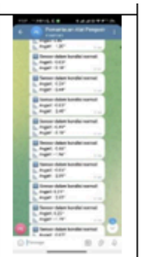
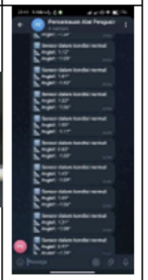
Oscilloscope results show the device produces 19.5–34.7 kHz ultrasonic signals. Waveforms ranged from smooth sine like to sharp square waves. Some instability appeared in later tests, likely due to interference or PWM issues. Overall, the device works well as we expected.

Testing notifications on telegram Test Result

Pengujian	Notifikasi	Status	Waktu (Detik)
Pengujian 1	Notif *ON*	Berfungsi	6
Pengujian 2	Notif *ON*	Berfungsi	6
Pengujian 3	Notif *ON*	Berfungsi	7
Pengujian 4	Notif *ON*	Berfungsi	6
Pengujian 5	Notif *OFF*	Berfungsi	4
Pengujian 6	Notif *OFF*	Berfungsi	5
Pengujian 7	Notif *OFF*	Berfungsi	4
Pengujian 8	Notif *OFF*	Berfungsi	4
Pengujian 9	Ubah *Threshold*	Berfungsi	6
Pengujian 10	Ubah *Threshold*	Berfungsi	6
Pengujian 11	Ubah *Threshold*	Berfungsi	7
Pengujian 12	Ubah *Threshold*	Berfungsi	6
Pengujian 13	Durasi Aktif	Berfungsi	3
Pengujian 14	Durasi Aktif	Berfungsi	3
Pengujian 15	Durasi Aktif	Berfungsi	3
Pengujian 16	Durasi Aktif	Berfungsi	3
Pengujian 17	Status Keseluruhan	Berfungsi	4
Pengujian 18	Status Keseluruhan	Berfungsi	4
Pengujian 19	Status Keseluruhan	Berfungsi	4
Pengujian 20	Status Keseluruhan	Berfungsi	4

Test results show the Telegram notification system respond well. The bot sends complete alerts when the tilt exceeds the threshold, with a 3–7 second response time. Features like Notif ON/OFF, Threshold Adjustment, Active Duration, and System Status work properly. Overall, the notification feature can function is stable and responsive

Battery Life Test for 12 hours Test Result

Pengujian	Status Pengujian	Penjelasan	Gambar	
			Alat	Telegram
1.	Berhasil	Dilakukan pengujian alat pada ruangan terbuka pada tanggal 4 sampai 5 mei sekitar 12 jam 6 menit.		
				
2.	Berhasil	Dilakukan pengujian alat pada ruangan terbuka pada tanggal 11 sampai 12 mei sekitar 11 jam 32 menit.		
3.	Berhasil	Dilakukan pengujian alat pada ruangan terbuka pada tanggal 5 mei sekitar 11 jam 31 menit.		
				
4.	Berhasil	Dilakukan pengujian alat pada ruangan terbuka pada tanggal 12 mei sekitar 12 jam 3 menit.		

The battery test results show that the device has an average endurance of **11-12 hours**, depending on sensor activity and data processing. This proves that the system has **good battery life** and is **suitable for night time monitoring**, especially nocturnal pests such as mongooses, when the pond is not monitored.

Weather Resistance Testing Test Result

Pengujian Pada saat Cuaca Panas			
Nomor Pengujian	Status Pengujian	Gambar	Penjelasan
1.	Berhasil		Pengujian dilakukan pada tanggal 4 Mei saat terjadi hujan dengan intensitas cukup deras, yang berlangsung selama 1 jam 28 menit.
			
2.	Berhasil		Pengujian dilakukan pada tanggal 11 Mei saat terjadi hujan dengan intensitas deras, berlangsung selama 2 jam 9 menit.

Pengujian Pada saat Cuaca Panas			
3.	Berhasil		4 Mei, pengujian dimulai pukul 13.13 siang. Cuaca saat itu relatif teduh, namun sempat diguyur hujan ringan sekitar pukul 13.30. Menariknya, cuaca kembali cerah dan panas mulai pukul 15.00 hingga malam hari. Ini memberikan variasi kondisi yang cukup ekstrem dalam satu hari.

The test results show the device is weather-resistant, functioning well in both heat and heavy rain. Sensor accuracy was maintained, with minor delays likely due to signal interference. Condensation was resolved using silica gel. Overall, the device remained stable with proper precautions.

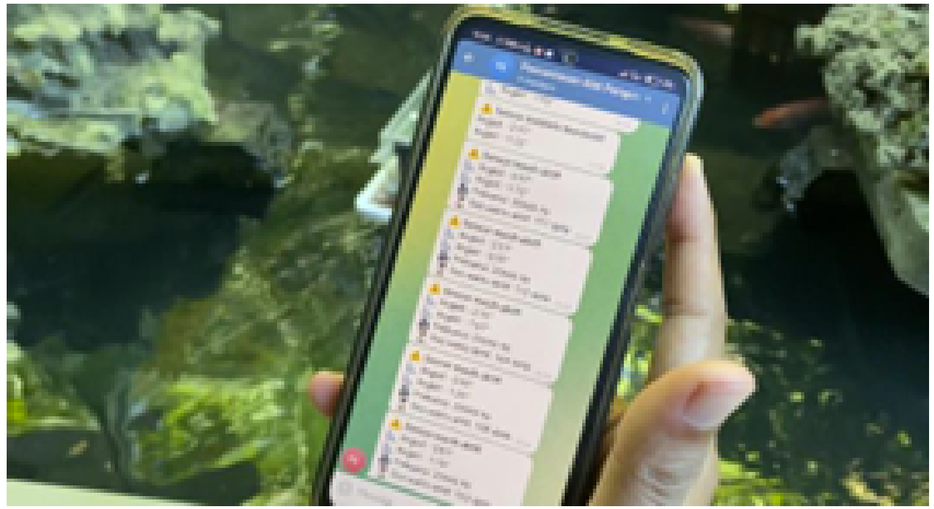
Testing on otters

Test Result

Pengujian pada hewan		
Pengujian	Gambar	Penjelasan
1.		Penguji memasuki kandang otter tanpa gangguan
2.		Otter tersebut mulai mendekati kolam yang disediakan
3.		Otter tersebut mulai berenang kedalam kolam yang tadi di sediakan
4.		Penguji memasukkan alat kedalam kolam yang berisi otter dan otter menjauhinya
5.		Penguji melakukannya berulang kali untuk mengusir otter dari dalam kolam
6.		Penguji belum sempat meletakkan alat otter tersebut sudah terlebih dahulu menjauhi
7.		Otter tersebut mengeluarkan suara yang keras pada saat alat lama diletakkan pada kolam

The test on an otter showed consistent avoidance behavior after device activation. In the fourth trial, the otter showed stress and aggression, so testing was stopped. The results show that the device can disturb animals such as otters with a certain time delay.

Testing in the fish pond Test Result



For the last experiment, the device was placed in a pond containing many fish, and the fish had no interference reaction to the device placed on the surface of the pond.

CHAPTER 5

CONCLUSION

Conclusion

The device can detect vibration/movement automatically and accurately using a gyroscope sensor.

The system showed stable performance and responsiveness to angle changes, and was able to adaptively adjust the frequency according to environmental conditions.

Although the frequency remains high, the waveforms in some tests are less stable and noisy, possibly due to interference or suboptimal PWM configuration.

Telegram notifications (ON/OFF, change threshold, duration, status) performed well with a response time of 3-7 seconds, proving the system is fast and reliable.

THANK YOU

MATURNUWUN

Telkom University