Many European, North American and other countries have high demand for vehicle antitheft systems (security systems). In such countries, systems equipped with self-powered sirens (having a built-in battery) for sounding alarms and intrusion detection sensors for detecting unlawful intrusion into the vehicle interior are used.

Japan too has seen a dramatic increase in car theft over recent years, which has set off a trend to introduce security systems comparable to those of Europe and America. Accordingly we embarked on development of a 24GHz radiowave-type intrusion detection sensor that can be used in Japan as well as other countries.

This thesis describes the features and other aspects of this newly-developed, globally-compatible 24GHz radiowave-type intrusion detection sensor.
Introduction

24GHz Intrusion Detection Sensor for Vehicle Antitheft Systems

2.1 Intrusion sensor’s detection technology and features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>High</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>High</td>
</tr>
<tr>
<td>Reliability</td>
<td>High</td>
</tr>
</tbody>
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Introduction

Background of the development
2.2 24GHz intrusion sensor

Aims of the development

<table>
<thead>
<tr>
<th>Aims of the development</th>
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<tbody>
<tr>
<td>Low-cost 24GHz high-frequency circuits</td>
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4.1 General configuration of moving object sensing radar

4.2 24GHz direct oscillation circuits
4.3 Reception/detection method

4.4 Principle of detection
Control of directivity

5.1 Necessity for directivity control

The necessity for directivity control in antennas is explained. The directivity of an antenna affects the performance of the system it is used in. Therefore, controlling the directivity is essential for optimizing the performance. Various factors contribute to the directivity of an antenna, such as the size, shape, and orientation of the antenna elements. In this section, we will discuss the importance of controlling directivity and how it can be achieved.

5.2 Directivity control method

Several methods for controlling the directivity of an antenna are presented. These methods include adjustable elements, such as slotted plates or rotatable arrays, and electronic techniques, such as phase shifting. The choice of method depends on the specific requirements of the application. An adjustable element method is shown in the figure.

5.3 Antenna configuration

The configuration of the antenna is crucial for controlling its directivity. Different configurations can be used to achieve different directivity patterns. The figure shows a configuration of an antenna designed for a specific application.

5.4 Simulation of directivity control

Simulation results are presented to demonstrate the effectiveness of the directivity control methods. The simulations were performed using a software tool that models the behavior of the antenna. The results show a significant improvement in the directivity pattern when the control method is applied.

The control of directivity is a critical aspect of antenna design, and understanding the methods and techniques for achieving it is essential for optimizing the performance of the antenna systems.
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