Adaptive Infrared Sensing for P.O.Box Status Detection

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ABSTRACT

In this paper, a successful application of sensitive object detection by using infrared sensor is introduced, namely, the P.O.Box Automation System. Meanwhile, an adaptive approach for tuning the radiant intensity is proposed for fulfilling different sensing distance and testing-paper thickness. The developed solution offers more convenient application of P.O.Box Status Detection.

I. INTRODUCTION

In general, most of the GaAs infrared emitting diode is applied for the remote control system, Herein, we would introduce another kind of application that aims to detect the P.O.Box status with high sensitivity, called P.O.Box automation system. It is jointly implemented in the Macau Post Office by Portuguese-Macau-Chinese partners.

The P.O.Box Automation System is aimed to provide a fast, convenient and economic way for checking the mail existence of the P.O.Boxes. Traditionally, People whose leased the P.O.Boxes need to go to the post office for checking if any letter exists in their boxes, however, the service will be limited by the location and the working time of the post office. Sometimes, the users just know that their boxes are empty only after they arrived to the post office. As the system was installed in most of the Post Office in Macau, the system users can inquiry the most update status of their boxes at any time though telephones. Furthermore, this system will notify the users automatically if their registered or fast delivery letter was received. In figure-1, the system configuration is shown. The detecting module and the Interactive Voice Response (IVR) module is responsible for the status sensing and users' inquiries and notifications, respectively.

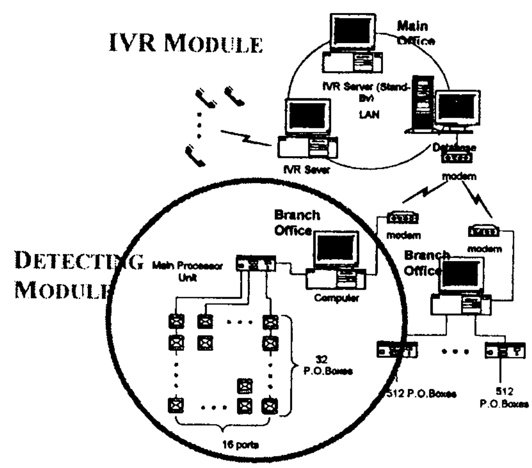

Fig-1. System Overview

In order to have a higher sensitive sensing performance, a GaAs type infrared emitting diodes and infrared receivers were selected. The infrared receiver requires 38KHz carrier transmission for avoiding the interference of the disturbed ambient.

Both the emitter and receiver are being located into the P.O.Box. The receiver is installed at the top of the box while the emitter is installed in the bottom. With putting a piece of thin paper in the P.O.Box (above the emitter), the infrared beam is cut and the discontinuity of the infrared signal will be recognized as "mail existing" by the microprocessor.

However, the radient intensity is needed to tune for P.O.Box with different height. Since the sensitivity is required to acheive for only one thin paper according to the reuquirement of

Macau Post Office, the tolerance and the aging of components may cause the radiant intensity decreaseing gradually under the acccpetable range. Then the system will report mail existenace only.

II. Adaptive Infrared Sensing

In order to solve the mentined porblem, an adaptive infrared sensing approach is proposed in this section. This function will be active manually if the information of mail existance is not correct due to the problems of componet aging.

The adaptive infrared sensing aims to tune the intensity of the infrared sensor in order to achieve for different distance and sensitivity. It varies adaptively the resistance that limits the forward current to the infrared emitting diode, as shown in figure-2.

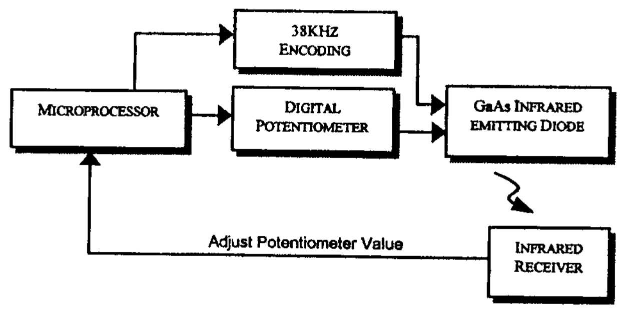

Fig-2. Adaptive Tuning Scheme

As shows in figure-2, the adaptive infrared sensing scheme is based on a microprocessor, and adjusts the resistance value of the digital potentiometer according to the feedback box status from the infrared sensor. The microprocessor initiates the resistance value of digital potentiometer from its maximum value and the resistance value will further be stepped down until the infrared ray can just pass through the testing paper. Therefore different sensitive can also be achieved by applying different thickness of testing paper standard.

III. Experimental Results

By making use the normal 80g A4-paper as the fundamental of testing standard, an experiment result of the average tuned resistance is shown in figure-3 for different distance emitter and receiver (100mm, 130mm, 160mm) and different paper thickness (no paper to 5 pieces of testing paper).

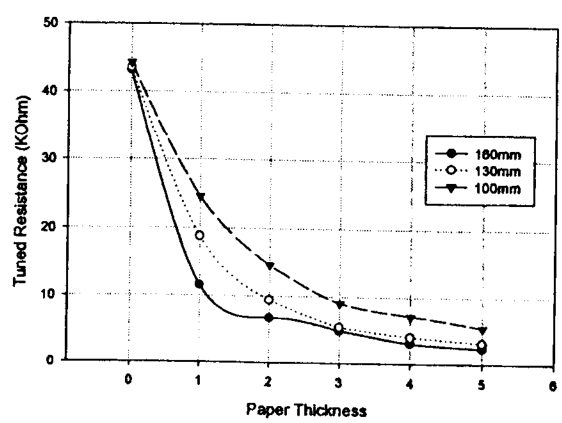

Fig-3. Tuned resistance for different paper thickness and distance

IV. Conclusions

From the graphical representation of the experimental result as shown in figure-3, the non-linear characteristic of the GaAs type infrared sensor is observed. Meanwhile, a lower resistance is obtained as the paper thickness increases or the sensing distance increases. It shows that the forward current supplied should be proportional to the distance and inversely proportional to the sensitivity. It verifies that the necessity of having an automatic adaptive scheme for tuning the radiant intensity.

V. Acknowledgements

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