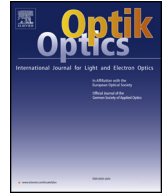




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Original research article

# Photonic structure for embedded application: Realization of optical filter based locking system

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## ABSTRACT

Optical filter based locking system using photonic structure is explored in this research. Here, photonic structure is envisaged by the apt periodic combination of silicon and air. The proposed photonic structure interface with hardware implementation to realize the optical fiber based locking system. This paper emphasizes on both simulation outcomes which is investigated through reflectance characteristics and hardware implementation using Arduino board to display the lock/ unlock status. Finally, this work divulges that different type of locking system may be designed with varying the input parameters of photonic structures.

## 1. Introduction

Though photonic structure is not new pertaining to Lord Rayleigh's notion in 1887 [1], E. Yablonovitch and S.Jhon's paper in 1988 enlightened a path to optical researchers for burgeoning new-fangled applications which is dealt with different photonic structure vis-à-vis one and two dimensional crystal [2,3]. However, recently some works related to 3-dimensional photonic crystal structure have been depicted in literature. As far as, one dimensional photonic structure is concerned, literature review indicates that these sorts of structures can easily be fabricated for various application, where the fabrication of 2-D photonic crystal structure is still underway and has not been reached at the heap of the mature stage. But, fabrication and development of 3D photonic structure is going sluggish due to technical constraints and also it is at infant stage with respect to current research scenario. Further, focusing on different recent application of one dimensional photonic structure, it is realized that various types of one dimensional photonic device have entered in the market [4,5]. Apart from this, different works related to current proposed structure have appeared in literature which deals with different types of application [6–9]. In reference [6], authors discuss optical interconnect application using silicon grating structure in millimeter range. Also, sensing application for investigation of temperature, concentration of chalcogenide and impurity concentration of silicon p-n and thyristor structure is comprehended in reference [6–8] and [9] respectively. Further considering communication based application related to grating structure is reflected in reference [10–15] which deals with spectral beam combination, monochromatic filters, interconnect, logic gate, HBL filter and SOI application respectively. The above published work belongs to purely one dimensional photonic structure and easy to fabricate it. The present work stands with similar types of structure. However application is quite different from aforementioned literature. For example, the current work divulges a new type of application vis-à-vis photonic with embedded application.

This paper is organized as follows: Section 2 analyses the optical structure filter based locking system including the components of each part, Section 3, demonstrates the simulation and explanation result and finally, conclusion are drawn in Section 4.

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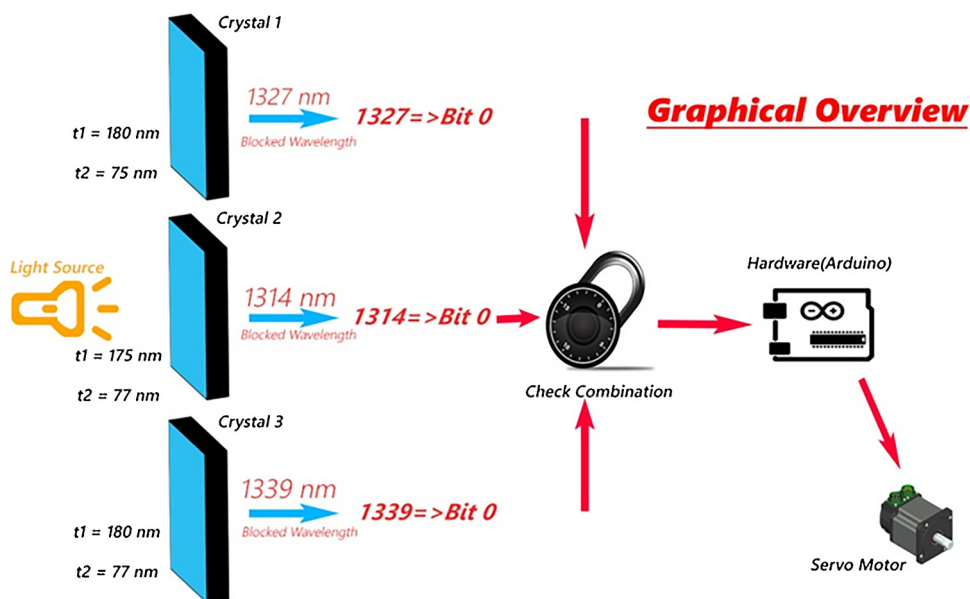


Fig. 1. Flow diagram of optical filter based locking system.

## 2. Filter based locking system

Fig. 1 represents flow diagram of optical filter based locking system. In this system, 83 layer of photonic structure (crystal 1–3) is a heart of the locking system. The principle of locking system is based on the matching of output potential from photo detector with comparator reference voltage. Then, if these two signals (potential from photo detector and comparator) is same then the system will be unlocked otherwise it will be locked. The same locking system and unlocking system is displayed and realized using Arduino hardware. The flowing explains each components of above structure;

Fig. 2 demonstrates the complete structure of optical filter based locking system and the following key components are explained as;

### 2.1. Switching knob

It is a simple knob which contains the range of wavelength or input signals. Here, the range of the input signals is taken of  $1.25 \mu\text{m}$ – $1.45 \mu\text{m}$ . the function of the proposed structure is only emanates the signal of aforementioned IR wavelength.

### 2.2. Silicon structure

It is the heart of the present research work. The part of the silicon structure in Fig. 1 consists of grating structure; such that nature

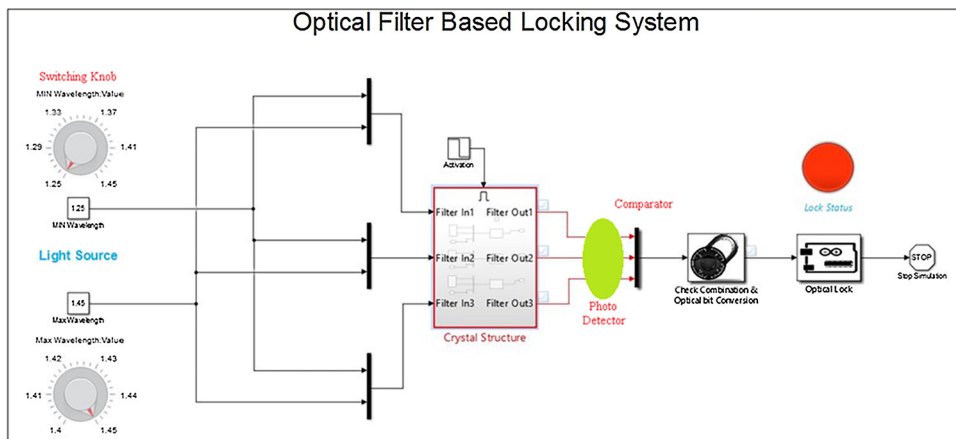


Fig. 2. Complete structure of optical filter based locking system.

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