Common Embedded System of Efficient Fungal Screening system

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Abstract—Fungusis dangerous to human health, food and archives. This is one of the major decompositions, as it is also fundamental to our ecological temple. The main purpose of this research is to develop a new automated embedded system for detecting fungi. It is specially designed to automatically collect the required amount of spores from the air and carry them under the micro camera using a handling system. The camera then takes separate images of the air sample using different light sources to successfully detect fungal spores. Atmel SAM4S microcontrollers are recommended for this task based on cost effectiveness and speed. In addition, the MATLAB graphical user interface (GUI) that controls the entire system was also developed. For evaluation purposes, accuracy and recall were used to confirm that 88% of the fungal spores were successfully classified as fungal spores. The developed embedded system automatically and efficiently performs all the important functions of a fungal detection system.

Keywords—Fungus detection system; Mold detection; Embedded system; Optical sensor system

I. INTRODUCTION

One of the most pressing development challenges remains hungry. Rather, the world produces enough food for human consumption. In fact, one third of the food produced is rotten.

1.3 billion tons per year [1]. One of the leading causes of low back pain is a fungus. While it plays an important role in the disruption of our ecosystem, it poses an inevitable threat to human life, food supplies, archives, buildings and other organic matter. The world has become a global market and trade between countries is growing rapidly. There is a strong need for fully automated systems that can monitor food quality during and after shipment. Temperature, humidity, CO2, and ethylene are commonly controlled in the food supply chain because they directly affect food quality [2]. Much research is currently being done into the detection of ethylene [1], [3], but fungi are another potential threat to commonly

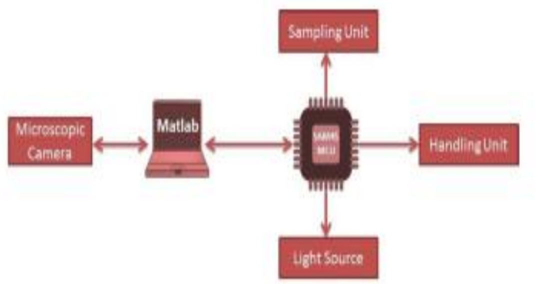

Fig.1:Blockdiagramofanembedded systemforthefungus detection

Overlooked foods [3]. It is important to note that many fungal spores grow rapidly In recent years, researchers have developed more molecular techniques for detecting mold in the environment. One of the latest fungal detection technologies includes fluorescent in situ hybridization (FISH), which requires efficient labour and long technology. Another technique requires tandem multiplex polymerase (PCR) chain amplification

It requires a concentration process and expensive equipment. Similarly, other approaches include DNA sequencing technology with rolling circular amplification and isothermal loop amplification (LAMP) and padlock probe technology [3]. Scientists have started using microscopes to track microorganisms, but they need trained professionals to create models and to observe and count fungal spores. All of the above methods yield reliable and accurate results, but are efficient, long labour, expensive and specialized equipment.

Previously, he proposed a fungus detection system based on computer vision [5]. Our system managed the fungal problem and successfully detected the fungal spores. First, the system collects air from the environment and then uses an optical sensor system to take a picture of the air sample [4]. Manipulating these images, we analysed sperm detection using directional gradient histograms and ship properties as shown in [4] and [2]. However, the purpose of this article is different. Here, we introduce an integrated system for automatic control of fungal detection systems. A detailed block diagram is shown in Figure 1. .

The rest of the paper is organized as follows: Section 2 briefly describes previous techniques used to detect fungi. Section 3 details the proposed approach to embedded organizations. Section 4 covers the test results and considerations, and finally Section 5 presents the conclusions.

II RELATED WORKS

Fluorescence in situ hybridization (FISH) is a molecular-based approach presented by Aman et al. [5]. It is a powerful method to detect organisms that are metabolically active in the environment. This technique enabled the biological organism to locate specific DNA or RNA sequences in the cytoplasm, organs, or nuclei. The probe was hybridized to DNA and RNA biological materials. Subsequently, hybrid sites were visualized. Recently, Li et al. [2] Fish were used for the fungicide on phytoplankton of apple seedlings. A few years later, Ohori et al. [5] used the LAMP technique and successfully identified Ocargonisgallopava. Similarly, Sun et al. [1] used it for rapid analysis of Penicilliummarnebii in preserved tissue samples.

Fujari et al. [2] proposed an approach to identify fungal disease in wheat and maize. They have used color images for this task. For colorization purposes, color, texture features were used and the K-mean segmentation method was applied to the section. Similarly, Wang et al 49] developed a new method for detecting staphylococcus aureus. This method used selective cultivation and computer vision system fMRDS, which allowed it to be detected faster and easier than most presentedinourfirstprototype[4].Next,aNikkon40Xoptical lenswasconnected infrontofthecamerausingaC-mount connector.Themagnification ofsystemwascalculatedusing Abbe-criterion[3]asshowninequation1,whereλ isthe wavelength oftheusedlightsource.AndNumericalAperture (NA)ofthelenswas0.65andNAofthecondenserwas0.54.

In a recent study, we developed a sensor system for detecting Ganesha axes in L [4]. It has an optical reference to identify axial growth. It has a reaction chamber in which there are electrodes. Axis is detected with the help of impedance changes in the reaction chamber, which changes the pH value. Of late he has provided a membrane-sealed biomarker technique for detecting fungi [3]. On the other hand, Tahir et al [4] proposed a new computer vision-based approach to fungal detection. They used an optical sensor system for image acquisition and a histogram of orientation gradient features for the classification of fungal spores and dirt.

III. MATERIALS ANDMETHODS

A.Setup

This embedded system consists of 6 subsystems: an Admel SAM 4S microcontroller, sample unit, handling unit, light sources, micro camera unit and computer. SAM4S Microcontroller was selected for this challenging task of detecting fungal spores. They range from 1 µm to 7 µm. The sampling unit has an air pump that is capable of absorbing the desired amount of air. The handling unit has three motors: two for left and right movement and one for upper and lower movement. Three different light sources are used for three different types of images (dark-field, bright-field, and autonomous fluorescence). An industrialtraditional method. AcomputerwasalsoutilizedwithMATLAB. Thesesub-systemswereconnectedasdisplayedinFig1.

B.Methodology

As shown in Figure 2, a GUI was developed for the purpose of control of the front end of the fungal detection system. At the back end, SAM4S is responsible for all controlling tasks. First, the GUI requested the user to connect to the desired SAM4S (microcontroller) port. Therefore, USB is the interface between MATLAB and the microcontroller. Before starting the automatic setting, it is necessary to set / check the brightness and brightness of the system. These options are available with the help of the sliding bar. Then, the user can click the Run button and the automatic fungal detection process will beginAt first, the air pump started operating and collected 200 litters of air per 20 litters per minute. An air pump has the capacity to collect air at different rates and at different speeds. All air samples were collected on a transparent, costly adhesive tape and made the system easy. After collecting air from the adhesive tape it will automatically shut down and the management system takes over. A signal pulse wide modulation (PWM) signal is required for the three system control motors. Therefore, a PWM signal of frequency 0 to 1000 Hz and a pulse of 40 µs were made. In 2 seconds, the sample time was reached under a small camera. After that the administration stopped working once.

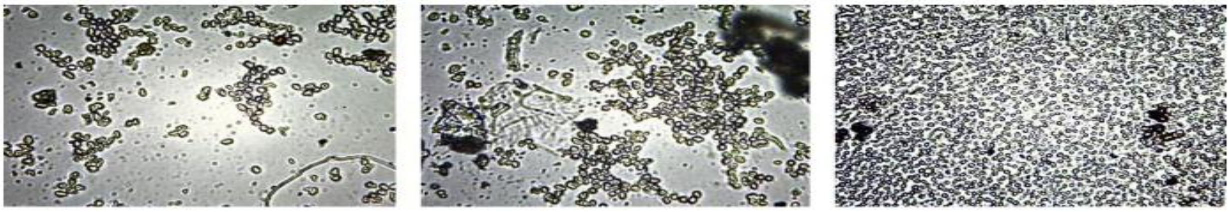

Fig.2:Categorizationoffungusimagesbasedonvolumeoftheair:(left)fungusimagewithlessthan30lofairvolume, (middle)fungusimagewithairvolumebetween30and100land(right)fungusimagewithairvolumebetween100and200l.

IV. CONCLUSION

Inthispaper,anembedded systemhasbeenpresentedfor thefungusdetectionsystem.Fivedifferentsubsystems were controlled usingSAM4Sandfungusimageswereassembled usinganopticalsensorsystem.Theobjectswereclassified as sporesanddirtusingasophisticated anddedicatedcomputer visionalgorithm, whichwaspreviously trainedonthesetypes ofimages.

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