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Automation Based Vegetable Slicer Using Image Processing

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ABSTRACT

This project is a novel attempt to completely automate the process of vegetable slicing. This project detects the vegetable, controls the knife and the vegetable movement and slicing is done accordingly. This involves various processes such as detection of vegetable using the identification of shape and colour through image processing, programming the FPGA kit in order to control the movements of the knife and also moving the vegetable in order to ensure that the whole vegetable gets sliced by a conveyor belt. In this work XILINX software, Spartan-3E FPGA (XC3S500E), the Arduino Uno board are used along with hardware implementation of the final setup. Vegetable identification system consists of three stages: capturing an image of vegetable, feature extraction and vegetable recognition. This mechanism consists of an integrated measurement and imaging technology with a user friendly interface. The Automatic recognitions of vegetables from images can recognize, analyze and process, based on color, shape, size, weight and texture. This new approach of a vegetable slicer is useful for both personal and commercial purpose.

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INTRODUCTION

Image processing now-a-days have varied applications in the fields of medical imaging, weather meteorology, computer vision, digital photography, microscopy etc. Object recognition is an important task in image processing and computer vision which involves determining the identity of an object observed in an input image. Vegetable recognition is done with the image processing and image analyzing. Image processing is done by MATLAB. In the recent work an efficient fusion of colour and texture features method is used for recognition purpose (Fruit Recognition using Color and Texture Features S) This system consists of an integrated measurement and imaging technology with a user friendly interface. Image is processed based on various features like color, shape, size, density, texture etc. These features are compared to stored data. Depending on the certainty of the classification and recognition, the final decision is made by the system. (Hridkamol Biswas, Faisal Hossain, 2013; Review). The classification technique is used to recognize the vegetable's shape, size, color and texture at a unique glance. The detection of vegetables is done using image processing and arduino uno board controls the movement of blade for slicing of the vegetables and conveyor belt movement.

2.Architecture Description:

The image of the vegetable is taken in the slicer itself and is processed and compared with the vegetable images stored in the database. The proposed system consists of Webcam, Matlab, Xilinx, FPGA, Arduino uno board, knife connected to the stepper motor and a conveyor belt connected to the dc motor. The stepper motor starts the movement of the knife and movement of the conveyor belt based on the command provided by the arduino uno board through USB cable. The binary data obtained through image processing in MATLAB of all the varieties of the vegetables is stored in the FPGA kit using Xilinx system generator. Once the input image of a vegetable is recognised then it's binary data is transferred from the FPGA kit to the arduino kit. The embedded C code is loaded into the microcontroller to control the motor movement. The motor movement is based on the binary data of the images of the vegetables. As 5V supply from the USB cable is not sufficient, an external power supply is provided in order to drive the motors.

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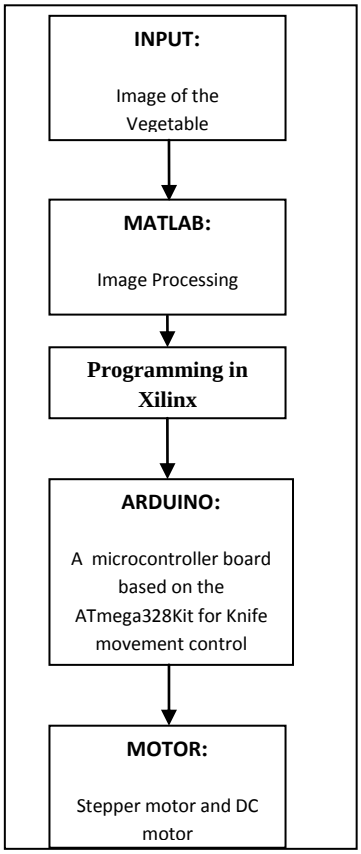

Fig. 1: Block diagram of the vegetable slicer.

Components Description:

3.1 XILINX:

Xilinx styles, develops and markets programmable logic merchandise, together with integrated circuits (ICs), package style tools, predefined system functions delivered as belongings (IP) cores, style services, client coaching, field engineering and technical support. Xilinx sells each FPGAs and CPLDs for equipment makers in finish markets like communication, industrial, consumer, automotive and processing. Xilinx FPGAs will run an everyday embedded OS and may implement processor peripherals in programmable logic. (FPGA)

3.2Arduino Uno Board:

The Arduino Uno is a microcontroller board supports the ATmega328. It has fourteen digital input/output pins, half-dozen are analog inputs, a sixteen megacycle per second ceramic resonator, a USB association, an influence jack, associate ICSP header, and a push button. It can be connected to laptop with a USB cable, with a AC-to-DC adapter or battery to induce. The Uno differs from all preceding boards, in this it doesn't use the FTDI USB-to-serial driver chip. Instead, it uses Atmega16U2 programmed in such a way as a USB-to-serial converter. The Arduino uno board acts as an interfacing device between pc and the FPGA kit, so as to transfer the binary information that is generated by the user within the laptop as input for the experiment. ((FPGA)).

Fig. 2: Arduino Uno Board

3.3 Array (Fpga):

It is associate degree computer circuit which may be designed by a client or a designer when producing. thus its 'field programmable'. Configuration of an FPGA is specified using Hardware description language (HDL). FPGAs contain an array of programmable logic blocks. Logic blocks can be configured to perform complex combinational functions, or merely simple logic gates like AND and XOR. In most FPGAs, logic blocks also include memory elements, which may be simple flip-flops or more complete blocks of memory. The Spartan 3E group of Field Programmable Gate Array (FPGAs) is particularly intended to meet the high volume needs, and its cost touchy purchaser electronic application issues it the greatly obliged edge over alternate variants of FPGA. Because of the cost factor Spartan 3E FPGAs are considered for wide range of consumer electronic applications. The evaluation board of a Spartan 3E starter kit has several embedded peripheral modules. These may include 8 LED indicators, facility to input 8bit umbers using Toggle switches, stepper motor interface with on-board motor, DC motor interface with on-board motor supporting direction control, audible buzzer indicator, UART serial port interface etc. (FPGA; FPGA).

Fig. 3: Spartan 3e Fpga

Conclusion:

This project has a different approach for digital processing of vegetable slicing. The conventional method of slicing was tedious using different types of blades and changing the blades depending on the vegetable. This work automates the mechanism of controlling the knife movements for precise movement and also moves the vegetable to make the slicing even more efficient.

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