INDOOR WAREHOUSE MANAGEMENT USING DRONES

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Abstract –In this paper, indoor warehouse management using drones is proposed. The overall system is aimed at enabling autonomous drones to detect, recognize Barcodes and QR codes, andto design and develop obstacle avoidance systemusing ultrasonic sensors. Unmanned aerial vehicle (UAV) which is commonly known as drones is an aircraft which is operated remotely by human operator or on-board computer.UAV'shelps in digital transformation of warehouses. They are advantageous given their ability to operate at heights, carry payload, fly autonomously.

Key Words: unmanned aerial vehicle(UAV), obstacle avoidance, ultrasonic sensor, Barcode, QR code, python, open CV.

1.INTRODUCTION

Warehouse management system (WMS) has been widely utilized within the industry to extend the efficiency in term of productivity improvement and manual labor value reduction. With the increasing type of delivery items in warehouse, checking for purchased items is troublesome. Moreover, within the warehouse, the item may well be located behind or below the opposite items. because the result, the item can't be easily seen by the inventory operator. Therefore, we propose a Barcode and QR (Quick Response) code system using computer vision library (open CV) along with obstacle avoidance system using ultrasonic sensors. Obstacle avoidance has been a point of interest in every research where a vehicle needs to transport autonomously. Since UAVs are being employed widely in various applications including military, transport, rescue etc. the primary step to realize autonomous flying is to try to a self-regulating system.

The main advantage of the UAV is its ability to fly in low altitude so that it can easily obtain more detailed infrastructure. The UAV is system operating in the sky not on the ground, the flight of UAV is more dangerous than autonomous vehicle which moves on the ground, since unexpected damage can be occurred during flight which causes falling and crash to people
or building. Therefore, it is very important to detect and avoid unexpected obstacles on the flight path when UAV operates autonomous flight mode. For this reason, many researches have been carried out for detecting and avoiding obstacles for the conventional UAV and various sensors such as vision, ultrasonic wave, and SONARS are having utilized for obstacle detection. Due to limitations of payload and battery, UAV have many restrictions on sensor mounting compared to ground vehicles. However, since lightweight sensors are developed and mass production is possible recently, various obstacle detection methods began to appear which employing multi-sensors.

2. System Overview

The hardware system to avoid obstacles in the flight of the UAVmainly contains three major components. First, a flight controller (FC) in charge of basic control of the UAV, second an onboard computer that assists the control of the UAV and processes data, and ultrasonic sensors to detect the obstacle, Finally, a system that can monitor the operation status of the UAV algorithm on the ground.

Real Time Barcode and QR code detection using python and OpenCV is done, where the camera decode and detects both barcode and QR code. Barcodes and QR codes are the main part of the product which has all the information inbuilt.

2.1 Obstacle Avoidance

The structure of hardware system for detect and avoid obstacles for UAV is shown in Fig 1. UAVs are controlled by a manned ground control station, which can send and receive commands between ground control station (GCS) and UAVs.UAV flight controllers use hardware configurations and 3DR Pixhawk is one among them. ArduPilot is a full-featured open source project, which supports several types of UAVs such as multicopter, fixed wing etc. Each type is configured into a single firmware file, which is then installed on the Pixhawk processor. This control board has some embedded sensors to provide useful data to Ground Control Station (GCS accelerometer, a barometer and a magnetometer. This autopilot is fully programmable and has Radio Controlled (RC) channel inputs and other sensors. The built-in hardware uses a different circuit to transfer control from the RC system to the autopilot. This prevents crashes of UAV and by safely land on the ground.During this work, a 3DR Pixhawk flight controller was used with ArduPilot available firmware. In order to transfer data to Arduino UNO, Pixhawk uses an USB connection. Once the obstacle is detected flight controller will send MAVLink message to ground control station.MAVLink is a header only message protocol that uses group of messages to transmit data between the UAV and Ground control station (GCS) Each message is byte-encrypted which contains sensor related content, which is then interpreted by Ground Station Control or by Arduino UNO, which will serve as a message intermediary between Pixhawk and GCS.

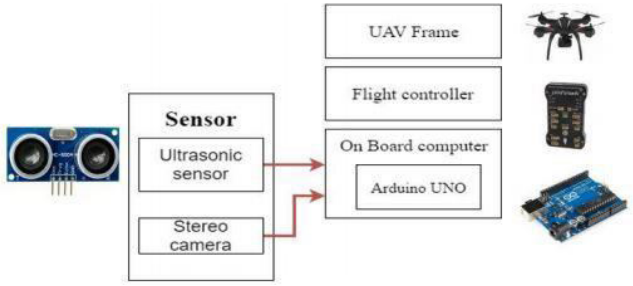

Fig -1: Block diagram of obstacle avoidance system

2.2Barcode and QR code reader

Barcode and Quick Response (QR) code is collection of data bits that describes the item. The data is represented in specific type of pattern. Earlier only one-dimensional bar codes were available. Later two-dimensional ones were developed in which all alphanumeric and other special characters were being used. There are basically two types of barcodes available Linear Barcode (1D Barcode) and Matrix Barcode (2D Barcode). The Barcodes and QR codes are used by the companies to easily maintain a reliable and fast, isolated database for Sales and Purchases.

Barcode and QR code detection are done by using Python programming using OpenCV to capture and process the image by usinga Pyzbar library. Once the camera started, each frame received are processed with the Pyzbar-scanner function and it will check for the existence of any barcode or QR code. Then blurring effect is applied so that it can reduce the noiseto do this 9*9 kernel is applied which provides the average blur and reducing the high frequency disturbance in the detected barcode and QR code then that is decoded with Pyzbar to get the information from it. The barcode and QR code data are then compared using any files to get any machine data or product id inside the warehouse.

3. RESULT

Inorder to verify of algorithms implemented, we simulated the operation of the obstacle avoid algorithm, also we mounted actual four ultrasonicsensors(HCSR04) on the UAV and then monitored the sensor's detection results on the remote monitoring software.Fig 2 shows the complete hardware setup of drone.

The final output image is represented, Real time Barcode and QR code detection is done and it took around 0.25 seconds to detect the image.The matched barcode and QR code data can be displayed as per the user's need. We can change the position of the data displayed and also the color and size of the fonts can be changed easily.

Fig 2: Hardware setup of Hexacoper.

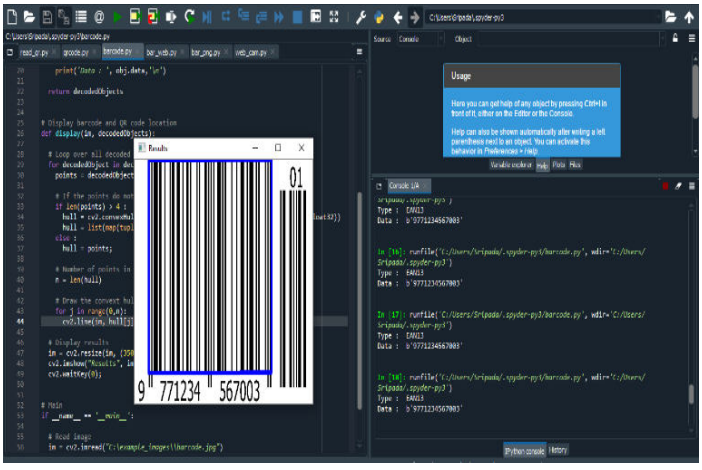

Fig 3: Barcode detection.

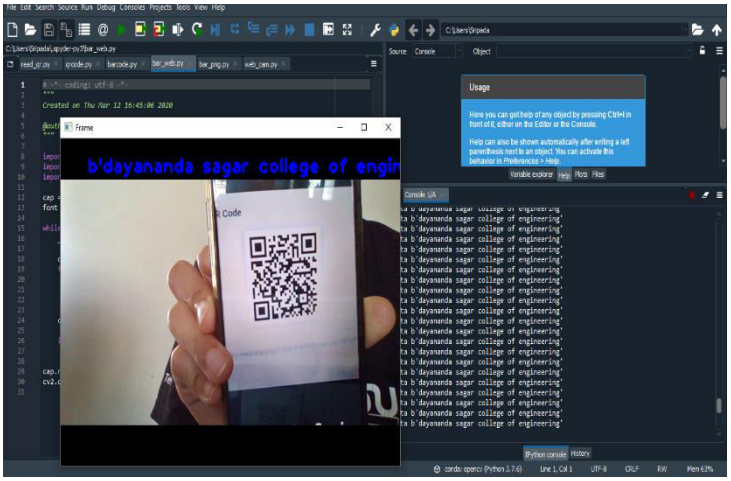

Fig 4: Real time QR code detection.

4. CONCLUSIONS

In this implemented system, we have developed the obstacle avoid system for automatic flight of UAV, and connected it with an actual UAV for simulation, and Real time detection of Barcode and QR code using python open CV is done.Through our experiments, we can able to confirmthat the combination of different sensors is far more efficient in terms of speed and performance, rather than using a single sensor to detect and avoid of obstacle.

ACKNOWLEDGEMENT

We take opportunity to thank Praveen k, General manager, Paras Aerospace solutions for his valuable guidance and providing all the necessary facilities in completion of this work. And would also thank Dr.T C Manjunath, HOD Department of Electronics and communication Engineering, and Prof. Sapna P J, for their guidance.

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