Development of a UAV Object Tracking OpenCV for Smart Security

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스마트 보안을 위한 UAV 객체 추적 OpenCV 개발
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Abstract

Lions and elephant, cows roam around the farm to kill and destroy farmer livestock now in Africa area. For this reason, productivity in agriculture decreases over time resulting in poor production of crops and even killing of poultry animals. The Development Drone for Driven Agriculture based on IoT Technology provides an effective way to ensure the protection of farms and agriculture against wild animals. An automatic Drone fly after receiving a signal from server OpenCV to hunt wild animals outside the farm. The output of Object detection is also the highlight of this project.

In this paper, we also discuss the OpenCV harr Cascades using Python for image detection and Drone operation to meet farm’s requirement. The UAV Drone is flown for hunting wild animals outside farm which is to prevent breach in farm security. Furthermore, the UAV Drone was developed through UAV technologies, with functionalities necessary for the successful deployment of a fully autonomous UAV operation over agriculture and traffic networks. The UAV is able to navigate autonomously at different altitudes, plan for mission goals such as locating, identifying, tracking and the development of reliable software and hardware architectures. This paper proposes a UML diagram including the design of the Unmanned Aerial Vehicle system and software in it. The software is called embedded software. Model-based testing is a resolution for testing embedded software.

Keywords: Drone, ICT Agriculture, Software Architecture, Machine Learning, OpenCV, Model Based Test

요 약

아프리카 대륙에서 양은 동물은 자유롭게 밖으로 이동하며 사자와 코끼리와 같은 육식 동물은 농업 농장에 따라 가며 밤에는 농부 가축을 죽이고 상처를 입힌다. 이에 따라 농업 생산성이 시간이 지남에 따라 감소 및 작물 생산성이 떨어지고 가금류가 줄어든다.

IoT 기반 드론 기술의 발전이 양과 동물로부터 농업과 농장을 보호할 수 있다. 또한 OpenCV 서버로부터 신호를 수신하여 자동 드론의 기술이 농장 밖의 양과 동물을 추적할 수 있다.

본 논문은 이 분야에서 기술은 위험을 줄이는 데 중요한 역할을 할 수 있다. 본 논문은 농부들이
1. Introduction

The world suffers daily natural disasters such as earthquakes during which many people lose their lives. Similarly, farms are also attacked by predators such as lions. Bumble bees can be used during the attack to determine the damage and its scope in the field of agriculture. Bumble bees are known as drones (UAVs). Unmanned aerial vehicle (UAV) platforms today are a valuable source of data for problem inspection, monitoring, mapping, and 3D modeling[1-2]. Unmanned aerial vehicles (UAVs) are ships capable of flying unmanned on board. They can be remotely controlled by an operator or can be independently controlled by pre-programmed flight paths. In our work, areas of application where images of unmanned aerial vehicles are used include agricultural safety. The drone can acquire images quickly for early impact assessment[3-4].

Current Issue; The lack of agricultural security technology still exists. In fact, the problem of "human hunting" in the agricultural sector of the non-agricultural security sector is becoming serious. The main problem for farmers is the lack of knowledge of modern agricultural techniques. Farmers continue to use old and obsolete farming methods, while technology has improved a lot. Numerous sectors of the economic cost attributed to livestock losses..

Our goal; The main objective is to develop UAVs using a software methodology to save agricultural labor costs. The high quality agricultural protection system designed to stimulate agricultural production. Development of simulation, specification and verification techniques, as well as modeling tools specific to complex environments. farms.

Our Motivation; It provides a real-time perspective of the movements of the crowd. We have used an unmanned aircraft to develop a secure farm, such as a UAV, which offers many benefits for integration in the processes and event planning tips. Real-time extra forecast function, high-precision safety environment control with drone application and continuous improvement of the software model.
2. Background and Related Work

The Review of the most recent unmanned vehicle show in Washington DC with emphasis on the new robot innovations and applications on display. The paper aims to discuss these issues like Design, Methodology, and approach which In-depth interviews with exhibitors of unmanned vehicles[6] and suppliers of other related equipment and support services. And the findings out is Unmanned vehicles are moving rapidly into new applications such as agriculture but agriculture security is not provided. It concludes that a value of this work is a review of some of the latest innovations and applications for unmanned vehicles that one might have seen if they had been on the exhibition floor at the most recent Washington DC unmanned vehicle show.

This paper proposes a model for MBT, which represents Embedded software such as an autopilot software of UAV. Unlike traditional modeling diagrams, the model covers failsafe behaviors[7]. It mean that MBT using the failsafe behavior model tests if the system manages failure-causing situations and handles their mitigations rightly. This paper proposed a multi-layered statechart diagram that includes normal behaviors and failsafe behaviors together. Traditional statechart diagram is used in Behavioral modeling, and the behavioral modeling builds diagrams that shows clients or users’ requirements. And MBT apply test criteria to the modeling diagram and design test cases and conclude this paper by mentioning a usage of the multi-layered state diagram in UAV.

2.1 Embedded Software Research

Embedded software[8] is harder to design. Embedded systems are increasingly networked, which introduces significant complications such as downloadable modules that dynamically reconfigure the system. Moreover, consumers demand ever more elaborate functionality, which greatly increases software complexity. These systems can no longer be designed by a single engineer fine-tuning tens of kilobytes of assembly code. Embedded software often encapsulates domain expertise, particularly when it must process sensor data or control actuators. Even very small programs may contain highly sophisticated algorithms, requiring a deep understanding of the domain and of supporting technologies, such as signal processing.

The emerging embedded software components business is a consequence of this complexity. It is very difficult to replicate a toll-quality speech coder or a radio modem with commodity
programmers. Existing software design techniques aren’t suitable. Partly because it is recent, and partly because of the domain expertise it requires, embedded software is often designed by engineers who are classically trained in the domain, for example in internal combustion engines[9]. They have little background in the theory of computation, concurrency, object-oriented design, operating systems, and semantics. In fact, it is arguable that other engineering disciplines have little to offer to the embedded system designer today because of their mismatched assumptions about the role of time and because of their profligate use of hardware resources. But these disciplines will be essential if the embedded software is to become more complex, modular, adaptive, and network aware.

3. Structure of Smart Security Drone of Farm

3.1 System Architecture

The system allows solving current issues such as : 1) no rate detection with Drone sound; 2) no rate detection with OpenCV server; 3) no automatic smart farm security; 4) expensive smart security for the farms; 5) Reduce frustrated of the farmer; 6) no animal detection in farms; 7) no real time security system for farm. The functions of the cradle included UAV Dorne; arduino to create a noise sound using a piezo speaker circuit; Camera; server composed of OpenCV.

The System architecture as presented in [Figure 8], The UAV permit to navigate autonomously at different altitudes, plan for mission goals such as locating, identifying, tracking after a detection. Once the Animal is detected by crossing the red-line, automatically UAV fly with the help of GPS to get the animal position. And Return to home base after a designated amount of time. For this scenario, it may be assumed that the UAV receives as input a vehicle signature from Server (OpenCV tracking ) after the object detected. The camera allows to take a picture/video the animal in front of the farm and get their feature.
3.2 Role of IoT

The UAVs equipped with diverse IoT devices: the UAV-based IoT platform.[10]. The figure demonstrates a widespread network of flying UAVs, each assigned to a specific task: some are flying, and some are ready to fly when needed. In addition to IoT services, IoT applications deserve special attention. The standardization of controls and capabilities of drone-driven IoT will occur due to industry diffusion, regulation, and agriculture. When equipped with diverse IoT devices, they can be used to form an integrative IoT platform operational in the sky. Everything is being wired up or connected wirelessly. The drones provide precise ground truth information, more accurate images as they are closer to the ground. [11] By using drones, we can adjust and measure the distance from terrain, calculate depth level and measure many more IoT applications.
3.3 Structure of Smart Security Drone of Farm

![S.W.O.T. Diagram]

- **S**
  - Additional real-time prediction function
  - High precision security environment control with drone application
  - Continuous software model improvements

- **W**
  - Application is limited to scare predators in a specific area
  - Used OpenCV instead of Machine learning

- **O**
  - Save agricultural labor expenses
  - High-quality farm protection system
  - Boost crop production

- **T**
  - Threats like innovation, education, ability, and skills to farmers to understand and handle the SSDF.

[Figure 2] WOT structure of Smart Security Drone of Farm

The opportunities of our project help the farmer to protect high-quality livestock and save on farm labor costs, as shown in [Figure 2]. The strengths add a continuous improvement of the software model because our system produces a prediction function in real time.

4. Design of Smart Security Drone of Farm

4.1 Role of IoT

A use case illustrates a feature unit provided by the system. The purpose of using use case diagram is to analyze functionalities of the system essential to ensure the safety of a farm[5]. A use case illustrates a feature unit provided by the system. Including a "user" relationship. As a general rule, a use case diagram is used to communicate the high level of functions indicated in our system, such as the detection camera, after detecting the characteristic of the animal system that the system has learned from the machine server. As illustrated in Fig. Then we can easily perform the functions provided by our system example.
The class diagram shows the entities "an intelligent farm security robot" that are exactly a real-time camera, Server Machine Learning, developed by Python, made with Arduino, UAV Drone, GPS; they are interrelated, as shown in [Figure 4].
4.3 Sequence Diagram

The sequence diagram presents a detailed flow for a specific use case that facilitates the operation of the application once the animal has been detected. It shows the tracking between the different objects of our sequence, as can be seen in [Figure 7].

![Sequence Diagram of A Smart Security Drone of Farm](image)

4.4 Sequence Diagram

OpenCV is broadly structured into five main components which are shown in [Figure 1]. The CV component contains the basic image processing and higher-level computer vision algorithms; HighGUI contains I/O routines and functions for storing and loading video and images.

![The Structure of OpenCV](image)
• OpenCV 3.3.1
• Python 3.6
• Numpy
• Image, Video input
• Install Pycharm IDE and PyQt5 and PyQt tools
  (PyQt5 started with open development using Python)
• OpenCV GUI with Detection Algorithm
  Python: cv2.CascadeClassifier.detectMultiScale

Detects objects of different sizes in the input image. The detected objects are returned as a list of rectangles[12].

5. Evaluating our model

This study was compared to other existing studies and has been evaluated

[Table 1] Comparison of system of the previous studies and the proposed framework
As shown in [Table 1], each system is compared and discussed with the following available features for evaluation. The following comparisons were taken from the following research papers discussed in the related work section of this manuscript.

The proposed system was presented to the end to determine its efficiency, security, usability, functionality, maintainability and portability of the system.

6. Conclusion

Agriculture farms suffer from these disasters like attacks from predators. Drones are part of the solution, Drones play a very important role in monitoring natural disasters. In our work, it can bring more security so that no predators shall cross certain boundaries within a specific area of farmland. We used drones, to secured farms, like UAV that offers a wide range of benefits when integrated into the plan and process to scare the predators. Also, we provided a real-time perspective of crowd movements. The system is smart security to protect the animal from predators. One of the advantages of this system it is a real-time and the system shows efficient use of algorithm process. The software architecture of applications and components which are discussed by using the UML diagram, the system saved the frequently used information in advance and provide a way to increase speed.
References


