

A Review on Surveillance using Thermal Imaging System for Animals and Birds in the Field of Agriculture

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ABSTRACT

Thermal imaging systems are most commonly associated with military and defense. It is most used by the military, army and in navy also for border surveillance and law enforcement. Also in the detection of heat leakage from buildings, inspection of defects on technical installations or building protection against the unwanted entry of undesirable persons. In the field of healthcare, both for humans and animals also it used. By considering the various application of thermal image this technique is helpful for farmers in detection of crop diseases. Not only crop disease but also in the detection of animals. This paper intends to focus on the survey on application of thermal image processing in agriculture field such as imaging techniques for crop protection in order to monitor the birds and animals.

Keywords : Surveillance, Thermal Imaging, Infrared Radiation (Thermal Camera).

I. INTRODUCTION

In India agriculture is the backbone of human nutrition. Now a days with growing population we need the productivity of the agriculture to be increased to meet the demands of humans. In olden days they used natural methods to increase the productivity, such as using the cow dung as a fertilizer in the fields as well as they have to protect their crops from animals and birds by making use of clowns in the field. But Wild animals are a special challenge for farmers throughout the world. Animals such as deer, wild boars, rabbits, moles, elephants, monkeys, and many others may cause serious damage to crops[1]. They can damage the crops by feeding on plant parts or simply by running over the field and trampling over the crops. Therefore, wild animals may easily cause significant yield losses and make additional financial problems. Another aspect to consider is that wild animal crop protection requires a particularly cautious approach.[2] In other words,

while utilizing his crop production, every farmer should be aware and take into consideration the fact that animals are living beings and need to be protected from any potential suffering. That resulted increase in the productivity enough to meet the requirements of the population. But later people started thinking of earning more profits by getting more outcome. [3] Control of wild animals and birds in the field of agriculture is very difficult task.

This major problem of farmer is overcome by a new technique called as Thermal image processing.

A. Thermal imaging:-

Thermal imaging is a method developed from Thermography at night vision that collects the infrared radiation from objects in the scene viewed by a thermal camera and creates an electronic image based on information about the temperature differences of the object.

In thermal image processing system various basic components are used which are shown in the block diagram.

B. Thermal Camera:-

A thermal imaging camera is a thermal imager that is essentially a heat sensor capable of detecting tiny differences in temperature. The device collects the infrared radiation from objects in the scene and creates an electronic image based on information about the temperature differences [4].

Uses of Thermal Imaging Cameras:-The modern versions of thermal imaging cameras were initially created for military use, but have now crossed over into a variety of avenues via security, Preventative Maintenance such as electronic and electrical circuits, Heating and Cooling Troubleshooting at home, Animal Health as Veterinary.

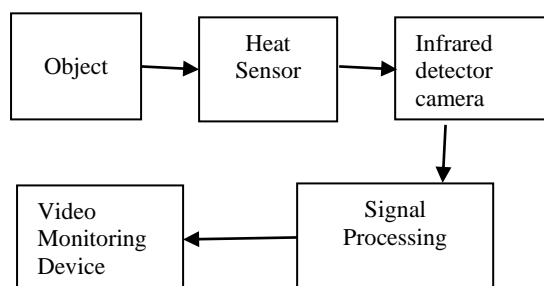


Figure 1 Block Diagram

C. Working of thermal imaging system:-

1. A thermal camera (thermal imager) having a special lens that focuses the infrared light emitted by all of the objects in the form of heat.
2. This focused light is detected and measured the infrared energy of object.
3. Then camera having infrared sensor pick the infrared wavelength and converts in the scene and creates an electronic image based on information about the temperature differences.

4. The infrared detector elements is then translated into electric impulses. The impulses are sent to a circuit board with a specialized chip that translates the information from the detector elements into usable data for the camera's display.

5. Lastly, the signal-processing unit sends the translated infrared information to the display, creating an image of various colors depending on the intensity (heat) of the infrared emission of the object.

6. Video monitoring device records the video and save in the computer which get processed by imaging techniques using matlab software.

II. RELATED WORK

A number of scholar's works have been found in the literature regarding the image processing and thermal imaging in the field of agriculture such as Irrigation Scheduling Using Thermal Imaging, Soil Properties Mapping, and Plant disease detection, Field Tile Mapping, Crop Maturity and Yield Mapping for increase in the production of agriculture.

- 1) Roselyne Ishimwe, K. Abutaleb, F. Ahmed, "Applications of Thermal Imaging in Agriculture—A Review- Advances in Remote Sensing" shows that, Potential use of thermal remote sensing in agriculture sector such as nursery, greenhouse monitoring, irrigation scheduling, crop disease detection, maturity of fruits and bruise detection in fruits and vegetables[5].
- 2) Malarvizhi .D, Lavanya .V, Nivetha Priya. M, "Night Vision Technology", shows night vision gadget (NVD) that enables pictures to be created in intensity levels of light moving toward darkness, also they clarifies different applications where night vision innovation is used to take care of different low light level conditions[6].
- 3) Ashish, Vijay, "Review on Thermal Image Processing Techniques for Machine Condition Monitoring" they discuss about the Infrared

thermography or thermal imaging which is very appropriate, flexible and noncontact method used for many types of manual benefit like as electronic component, building surveys, and mechanical component but this technology nowadays used in machine conditioning observing such as fault detection, identification and resemblance for fault diagnosis. This paper represents a survey on various thermal imaging techniques for fault diagnosis and detection is based on the temperature of object. Image Histogram and Image Filtering techniques are used for thermal image inspection. The method for contrast enhancement and actual edge filtering is based on statistical differencing, where each pixel value is ascend by standard deviation and by using this they classify different machine conditions of thermal image. Feature such as standard deviation, mean, energy, and entropy are extracted from an image. The method used for classification of an image and machine condition diagnosis is Artificial Neural Network.[7]

- 4) Mritunjay Rai, Tanmoy Maity, R. K. Yadav, "Thermal imaging system and its real time applications: a survey" shows real time application of thermal imaging system i.e. application in agriculture, medical diagnosis, detection, tracking and recognition of humans along with their facial expressions[8].
- 5) Tejas G. Patil & Dr. S. P. Shekharwat, "Thermal Image Processing in Horticulture Sector-A Review" shows the overall mechanism of thermal image processing in quality inspection process along with proper implementation. Also shows the various applications for horticulture products[9].
- 6) Stephen S. Ditchkoff, Joshua B. Raglin, Jordan M. Smith, and Bret A. Collier, "From the Field: Capture of white-tailed deer fawns using thermal imaging technology" shows that this technique is equally or more efficient than other reported capture techniques for capture of neonatal white-tailed deer[10].
- 7) Justyna Cilulko, Paweł Janiszewski, Marek Bogdaszewski & Eliza Szczygielska "Infrared thermal imaging in studies of wild animals" shows that in wildlife surveys, thermal imaging tools support the acquisition of results that cannot be obtained by any other method, and they contribute to the improvement of other analytical methods. Despite several limitations, thermography can be expected to enter mainstream use as advances are made in other areas of science, including information technology, engineering, and graphic design. The versatility of thermal imaging applications, the ease of measurement, and the relevance of the produced results will undoubtedly make thermography a leading tool in wildlife surveys in the future [11].
- 8) C Lavers¹, K Franks¹, M Floyd¹, A Plowman, "Application of remote thermal imaging and night vision technology to improve endangered wildlife resource management with minimal animal distress and hazard to humans", demonstrated how using thermal and Near Infra-Red (NIR) imagery be safe in wildlife observation, diagnostics.[12]
- 9) TANJI Eijirou, OOKUBO Shuuichi, "Infrared Camera Image Processing Technology and Examples of Applications" shows how Infrared camera is used to improve the resolution of infrared cameras and how it can be applied in structure diagnosis.[13]
- 10) Denise Karp, "Detecting small and cryptic animals by combining thermography and a wildlife detection dog" show that thermal imaging camera is best used in areas with no or low vegetative cover, the thermal drone can be used up to medium vegetative cover, whereas the detection dog method is best applied where vegetation is very dense and not suitable to be searched using thermography.[14]
- 11) "Application Fields of Infrared Thermography" shows the various application of thermal imaging[15].

- 12) Sanjiv Fernando , “Seeing in the dark and more: Facts and FAQs about thermal imaging” shows that the various application of thermal imaging in the field of military, ecology and zoology, marine life[16].
- 13) Kim Arild Steen, Andr'es Villa-Henriksen, Ole Roland Therkildsen and Ole Green, “Automatic Detection of Animals in Mowing Operations Using Thermal Cameras” shows that how thermal imaging and digital imaging processing play an important tool for the improvement of wildlife-friendly farming.[17]
- 14) Mark Desholm, “Thermal Animal Detection System (TADS), Development of a method for estimating collision frequency of migrating birds at offshore wind turbines” shows in his book that the thermal camera and its related hardware and software, the TADS, are capable of recording migrating birds approaching the rotating blades of a turbine, even under conditions with poor visibility[18].
- 15) Anupma Prakash, “Thermal Remote Sensing: Concepts, Issues And Applications” show that the potential of thermal remote sensing.[19]
- 16) Carosena Meola and Giovanni M Carlomagno, “Recent advances in the use of infrared thermography” shows the use of infrared thermography in three thermo-fluid dynamics, technology and cultural heritage field. Also it shows the different thermographic methods.[20]
- 17) Wang shiyun, Chang ben kang, Yu chunyu, zhang jufu, Sun lianjuna, “Un-cooled thermal imaging and image analysis” shows that how the temperature of object get change from one to other. This is useful for detection of animals and birds in the farms.[21]
- 18) Wang Yongqing, Gu Zongqing, Wang Shuonan, He Ping, “The temperature measurement technology of infrared thermal imaging and its applications review”, shows that the basic principles of infrared thermal imaging technology, and the survey in the fields of military, medical, electric power, industry, architecture, agriculture and forestry.[22]
- 19) Shazia Shaikh, Nazneen Akhter, Ramesh Manza “Current Trends in the Application of Thermal Imaging in Medical Condition Analysis” shows applications of thermal imaging in medical field where thermography helps for heat analysis.[23]

III. CONCLUSION

Thermal image processing (TIP) deals with manipulation of Thermal images through a Thermal camera. In this paper various types of TIP based paper are presented in the literature are discussed and analyzed. This shows that for detection of animals and birds in farming the TIP technique using night vision camera is fruitful for farmer for detection of birds and animals in farms which makes damage to the crop.

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Cite this article as :

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Dipti Anurag Doshi, "A Review on Surveillance using Thermal Imaging System for Animals and Birds in the Field of Agriculture", *International Journal of Scientific Research in Science and Technology (IJSRST)*, Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 7 Issue 3, pp. 340-345, May-June 2020. Available at doi : <https://doi.org/10.32628/IJSRST207356>
Journal URL : <http://ijsrst.com/IJSRST207356>