



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Implementation Of Motion -Activated Wildlife Recording Camera Using Raspberry Pi

E,MOULIKA, B.Tech III- ECE
(226F1A0415),

Department of Electronics and Communication Engineering , Pallavi Engineering College, Survey No.209, Swathi Residency Road KUNTLOOR, Hayathnagar, Kuntloor Village, Hayathnagar_Khalsa, Hyderabad, Telangana 501505.

Dr. K. NAVEEN KUMAR, M.Tech.,
Ph.D., MISTE., MIAEng., MIETE

Professor & HOD of Department of Electronics and Communication Engineering, , Pallavi Engineering College, Survey No.209, Swathi Residency Road KUNTLOOR, Hayathnagar, Kuntloor Village, Hayathnagar_Khalsa, Hyderabad, Telangana 501505.

MR.B.MADHUKAR, M.Tech

Assistant Professor of Electronics and Communication Engineering, , Pallavi Engineering College, Survey No.209, Swathi Residency Road KUNTLOOR, Hayathnagar, Kuntloor Village, Hayathnagar_Khalsa, Hyderabad, Telangana 501505.

P.LOKESH, B.Tech III- ECE
(226F1A0433),

Department of Electronics and Communication Engineering , Pallavi Engineering College, Survey No.209, Swathi Residency Road KUNTLOOR, Hayathnagar, Kuntloor Village, Hayathnagar_Khalsa, Hyderabad, Telangana 501505.

K.PRASHANTH, B.Tech III- ECE
(226F1A0422),

Department of Electronics and Communication Engineering , Pallavi Engineering College, Survey No.209, Swathi Residency Road KUNTLOOR, Hayathnagar, Kuntloor Village, Hayathnagar_Khalsa, Hyderabad, Telangana 501505.

B.HARSHITH, B.Tech III- ECE
(236F1A0442),

Department of Electronics and Communication Engineering , Pallavi Engineering College, Survey No.209, Swathi Residency Road KUNTLOOR, Hayathnagar, Kuntloor Village, Hayathnagar_Khalsa, Hyderabad, Telangana 501505.

ABSTRACT: Getting wildlife footage is a difficult task. Cameramen need to wait for hours or even days without moving to get desired footage. Here we propose an automated system with a motion-activated recording camera that starts recording only when motion is detected. This has a lot of advantages. To get the right moments footage the camera needs to be kept in recording mode for entire days or nights. Well, this system saves battery as well as storage as it only records footage when motion is detected. The system consists of a motion sensor with a camera and sd card circuitry interfaced to a raspberry pi. The pi is used

to process the sensor input to detect any motion. The camera recording is kept off if no motion is detected. As soon as motion is detected the raspberry pi records footage and sound of the motion and again stops recording when motion is not detected which is saved in the memory card for later viewing. Thus, we get only desired footage & sound recording from the camera and microphone thus saving unnecessary battery as well as storage space.

Key Words: Raspberry Pi, Motion sensor(PIR), Camera, light sensor, Battery

INTRODUCTION:system on an embedded system. Before delving into its implementation, an introduction is needed to the parts involved in the project. The whole report is centered around the field of embedded systems and the use of Linux to run applications on them. Hence an introduction to Embedded Systems and using Linux as an OS in them is provided. Surveillance is the process of monitoring the circumstances, an area or a person. This generally occurs in a military scenario where surveillance war areas and adversary territory is crucial to a nation's security. Human surveillance is accomplished by conveying work force close sensitive areas so as to continually screen for changes. People have their restrictions and organization in blocked off spots is not generally possible at all the time. There are also added risks of losing work force in the occasion of getting got by the adversary. Apart from the obvious advantage of not losing any work force, physical and ethereal robots can detect subtle elements that are not evident to people by furnishing the robots with high resolution cameras and different sensors, it is possible to gain information about the particular location remotely. Satellite communication makes it conceivable to speak consistently with the robots and acquire real time audio visual feedback. Thus in recent times surveillance technology has become an area of great research interest. Over the years the need for security and surveillance systems has changed significantly due to the influence of various events and attacks. Monitoring wildlife in their natural habitat without disturbing them is a crucial aspect of environmental research, conservation, and education. Traditional wildlife observation methods can be invasive, labor-intensive, and may not capture rare or nocturnal animal activity. To address these challenges, this project proposes the development of a **motion-activated wildlife recording camera using a Raspberry Pi**. By integrating a motion sensor (like PIR) with a camera module, the system can detect animal movement and automatically start recording video or capturing images. The Raspberry Pi, a cost-effective and compact microcomputer, serves as the central controller for data processing, storage, and automation. This project not only enables efficient and non-intrusive wildlife monitoring but also offers flexibility for remote deployment in diverse environments such as forests, national parks, and research stations.

This system uses a **PIR (Passive Infrared) sensor** to detect movement and a **Raspberry Pi Camera Module** to capture footage only when motion is detected. This saves storage space and power, making the solution ideal for long-term field deployment.

□ How It Works

- **Idle State:** The system stays in a low-power idle mode, constantly monitoring for motion.
- **Motion Detection:** When the PIR sensor detects movement, it sends a signal to the Raspberry Pi.
- **Image/Video Capture:** The camera module is triggered to start recording or taking photos.
- **Storage:** The media is saved locally (e.g., on an SD card) or uploaded to cloud storage if connected.
- **Optional:** A real-time clock (RTC) module can timestamp the footage, and a battery + solar panel can power the system in the wild.

□ Key ComponentS:

- **Raspberry Pi 3/4** with microSD card
- **Raspberry Pi Camera Module**
- **PIR Motion Sensor**
- **Power Supply (Battery Pack or Solar Panel with Battery Management)**
- **(Optional)** RTC Module, USB Storage, or Wi-Fi Dongle

Existing and Proposed Methodology:

Existing Methodology: Existing methods for developing motion-activated wildlife camera systems using Raspberry Pi primarily fall into three categories: **PIR sensor-based systems**, **computer vision-based detection**, and **AI-enhanced models**. The most common and cost-effective method uses a **Passive Infrared (PIR) sensor** to detect motion in the environment. When movement is sensed—typically from an animal—the PIR sensor sends a signal to the Raspberry Pi, which then activates the camera module to capture an image or record video. This approach is simple, energy-efficient, and suitable for remote areas, but it may result in false triggers from environmental factors like wind or falling leaves. To improve accuracy, some systems employ **OpenCV-based motion detection**, where continuous video frames are analyzed using the Raspberry Pi's processing power. When significant differences are found between frames, the system determines motion has occurred and initiates recording. While this method reduces hardware needs and allows finer motion control, it requires more computational power and consistent lighting conditions. A more advanced approach integrates **AI and machine learning**.

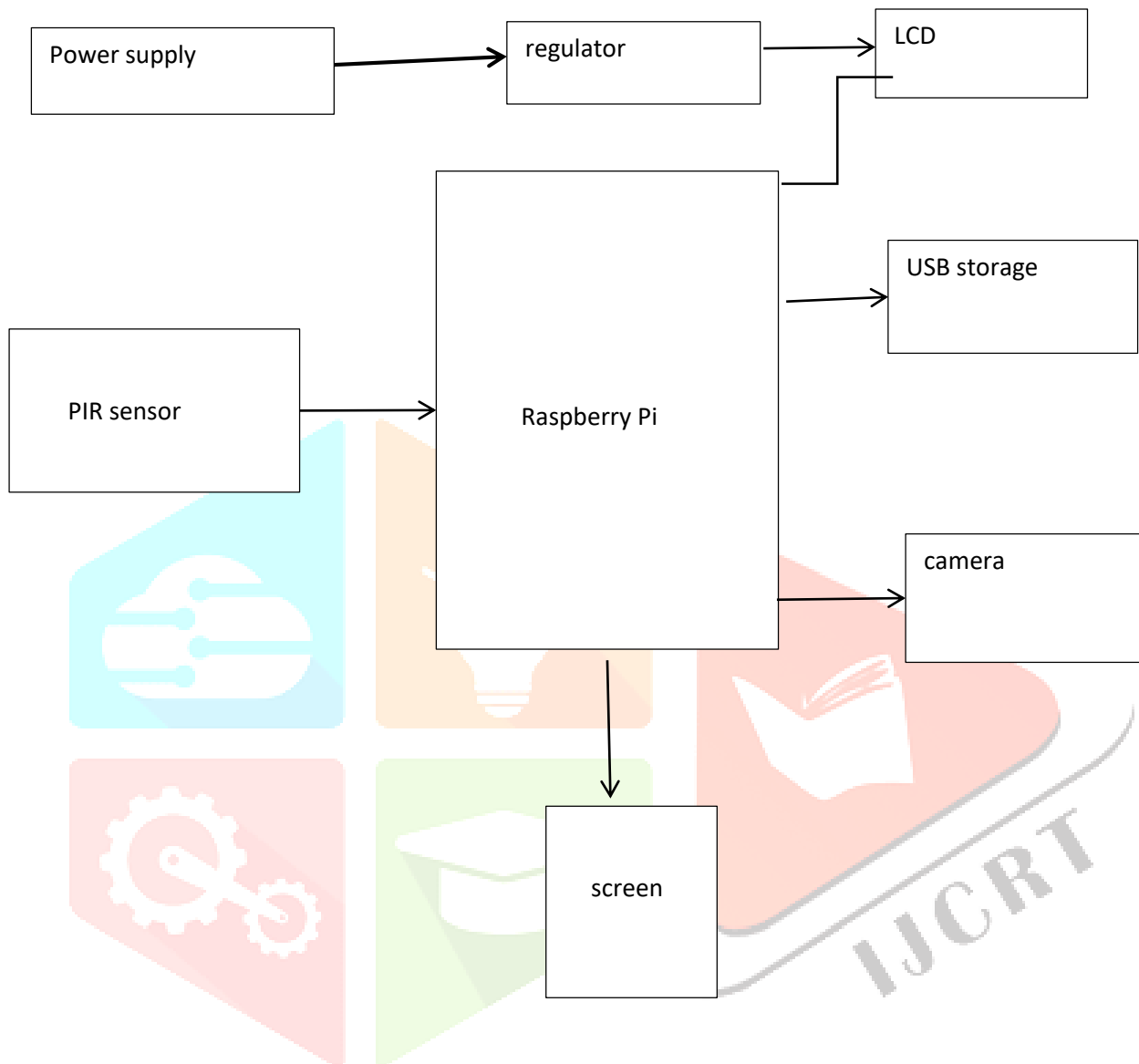
KEY COMPONENTS:

- **Raspberry Pi (Model 3B+, 4, or Zero W):** Acts as the central processing unit.
- **Raspberry Pi Camera Module or USB Camera:** Captures high-resolution images or video upon motion detection.
- **PIR (Passive Infrared) Sensor:** Detects motion by sensing changes in infrared radiation from moving objects (like animals).
- **MicroSD Card (16GB or higher):** Stores the operating system (e.g., Raspbian), Python code, and captured media files.
- **Power Supply (Battery Pack / Power Bank / Solar Panel):** Provides power to the system, especially useful for deployment in remote outdoor locations.
- **Python Programming Scripts:** Handles logic for motion detection, image/video capture, and storage.

Proposed Methodology: The proposed method for a motion-activated wildlife recording system using Raspberry Pi aims to create an efficient, low-cost, and automated solution for monitoring wildlife in natural habitats. In this system, a **PIR (Passive Infrared) sensor** is used to continuously monitor the surroundings for any movement. When motion is detected, the sensor sends a signal to the **Raspberry Pi**, which then activates the **camera module** to capture an image or record a short video clip of the detected activity. The recorded media is stored on a **microSD card**, ensuring that no data is lost even in areas without network access. To improve accuracy and reduce false triggers, the system can optionally use **computer vision techniques** such as **OpenCV** or lightweight **AI models (like TensorFlow Lite)** to verify whether the motion was caused by an animal. Additionally, modules such as **Wi-Fi** or **GSM** can be integrated to send real-time alerts or transfer data to cloud storage, enabling remote access. The entire setup is housed in a **weatherproof casing**, making it suitable for deployment in outdoor environments. The proposed system is energy-efficient, easy to deploy, and scalable, making it ideal for researchers, conservationists, and forest monitoring applications.

Key Components:

- **Raspberry Pi (Model 3B+, 4, or Zero W):** Acts as the central processing and control unit for the system.
- **Raspberry Pi Camera Module:** Captures images or videos when motion is detected. **PIR (Passive Infrared) Sensor:** Detects movement in the environment by sensing changes in infrared radiation.
- **MicroSD Card:** Stores the operating system, Python scripts, and captured images/video.

Block Diagram :

Applications:

Here are the **applications** of a **motion-activated wildlife recording camera using Raspberry Pi**, along with **detailed explanations**:

➤ **Wildlife Monitoring & Research**

Explanation: The system helps researchers observe animals in their natural habitat without disturbing them.

- ✓ It allows **tracking behavior, movement patterns, feeding habits, and population data** over time.
- ✓ Especially useful for studying **rare, endangered, or nocturnal species**.

➤ **Anti-Poaching Surveillance**

Explanation: The camera can detect human movement in protected areas where no one should be present.

- ✓ Raspberry Pi can be configured to **send alerts via SMS or email** when unauthorized motion is detected.
- ✓ Helps forest departments and NGOs **combat illegal poaching and logging activities**.

➤ **Habitat & Biodiversity Studies**

Explanation: By setting up multiple areas in different zones, researchers can **assess biodiversity** in forests, wetlands, or other ecosystems.

- ✓ Helps evaluate **human impact, climate change, or habitat loss** on species distribution.

➤ **Educational and Citizen Science Projects**

Explanation: Schools and universities can use these projects to teach students about:

- ✓ Programming and electronics (Raspberry Pi, Python, sensors)
- ✓ Environmental science and conservation.

➤ **Backyard or Urban Wildlife Observation**

- ✓ **Explanation:** People interested in nature can use the camera to monitor **wildlife in gardens, parks, or urban areas**.
- ✓ Captures videos of birds, squirrels, or nocturnal animals like owls.
- ✓ Encourages awareness and appreciation of local biodiversity.

➤ Night-Time Animal Tracking

Explanation: With **IR (infrared) night vision**, the camera can record animals active during the night, which are typically harder to study.

- ✓ Helps in **tracking predator-prey interactions**, migration at night, or roosting behavior.

➤ Environmental Impact Assessment

Explanation: Used during **construction projects or deforestation activities** to monitor animal movement.

- ✓ Ensures that development projects comply with environmental guidelines and avoid disturbing wildlife.

➤ Security in Remote Areas

Explanation: In addition to wildlife, the camera can also be used to **monitor intrusions in farms, forest cabins, or research stations**.

- ✓ Alerts can be sent if there's any movement detected in protected or sensitive areas.

➤ Agricultural and Livestock Protection

Explanation: Farmers can install the system near crop fields or barns to detect **wild animal intrusions (e.g., wild boars, deer, etc.)**.

- ✓ Helps **reduce crop damage or protect livestock** from predators like leopards or jackals.

Advantages:

Here's a **detailed explanation** of the **advantages of a motion-activated wildlife recording camera using a Raspberry Pi**, especially in the context of wildlife observation, conservation, and educational projects:

➤ Energy Efficiency

Explanation: In remote areas where power sources are limited (like forests or nature reserves), conserving energy is crucial.

- ✓ The Raspberry Pi can be programmed to activate the camera **only when motion is detected** (using a PIR sensor or computer vision).
- ✓ This avoids continuous recording, which would otherwise **drain the battery or solar-powered system** quickly.

➤ Storage Optimization

Explanation: Wildlife cameras can generate huge amounts of data if they record continuously.

- ✓ With motion activation, the camera only stores video **when animals are actually present**, greatly reducing the use of SD card or external storage.
- ✓ This makes it easier to manage and analyze footage, as **useless or empty recordings are avoided**.

➤ Non-Intrusive Wildlife Monitoring

Explanation: One of the goals of wildlife observation is to study animals in their **natural behavior** without human interference.

- ✓ A Raspberry Pi-based camera system can be placed discreetly in habitats, and since it activates only on motion, **animals are not disturbed**.
- ✓ It's ideal for capturing footage of shy, endangered, or nocturnal species.

Drawbacks:

Here are the **drawbacks (limitations) of a motion-activated wildlife recording camera using Raspberry Pi**, with detailed explanations:

➤ Limited Power Supply in Remote Areas

Explanation: Raspberry Pi requires a stable power source. In remote locations without electricity, powering it with **batteries or solar panels** can be challenging.

- ✓ Extended use might require **frequent battery changes** or larger solar setups, which increases complexity and cost.

➤ Environmental Durability

Explanation: Raspberry Pi and its components are **not weatherproof** by default.

- ✓ In outdoor environments, they need **protective casing** to withstand:

Rain or snow

Extreme heat or cold

Dust and animals

- ✓ Improper weatherproofing can lead to **device failure or damage**.

➤ Limited Camera Quality

Explanation: Raspberry Pi Camera Module (especially earlier versions) may not have the same **image quality, zoom, or night vision** as professional wildlife cameras.

- ✓ Low light or long-distance footage might be blurry or underexposed unless **enhanced with additional IR LEDs or better lenses**

Future Scope:

Here are several **future improvements** that can enhance the performance, reliability, and usability of the **motion-activated wildlife recording camera using Raspberry Pi**:

➤ Solar Power Integration

- ✓ **Improvement:** Add a **solar panel with battery storage** to make the system self-sustaining.
- ✓ **Benefit:** Enables long-term deployment in remote areas without needing manual recharging.

➤ GSM/4G Connectivity

- ✓ **Improvement:** Integrate a **GSM or 4G module** (like SIM800L or USB dongles) for internet access in areas without Wi-Fi.
- ✓ **Benefit:** Allows **real-time alerts, cloud uploads, and remote monitoring** even in deep forest or rural zones.

➤ AI-Based Animal Recognition

- ✓ **Improvement:** Use lightweight machine learning models (e.g., **TensorFlow Lite, YOLOv5-nano**) to detect and classify specific animals.
- ✓ **Benefit:** Reduces false positives and automates **species identification**, enabling smarter logging and research.

➤ Enhanced Night Vision

- ✓ **Improvement:** Add **high-power infrared (IR) LEDs or thermal sensors** for better night-time visibility.
- ✓ **Benefit:** Enables clearer videos of **nocturnal animals** in low-light environments.

➤ **Weatherproof Enclosure**

- ✓ **Improvement:** Design a **rugged, waterproof, and dustproof casing** (e.g., IP65 rated).
- ✓ **Benefit:** Protects components from rain, humidity, heat, and wildlife interference, allowing **year-round outdoor use**.

➤ **Larger or Cloud-Based Storage**

- ✓ **Improvement:** Integrate **USB drives, external SSDs**, or configure **cloud syncing** (Google Drive, AWS S3).
- ✓ **Benefit:** Allows longer recording sessions and remote backup without worrying about SD card space.

➤ **Web Interface for Live View and Settings**

- ✓ **Improvement:** Build a **web dashboard** using Flask or Node.js to access live footage, change settings, and view logs.
- ✓ **Benefit:** User-friendly control for non-technical users and easier **remote access**.

➤ **Smart Notifications and Alerts**

- ✓ **Improvement:** Implement **email, SMS, or app notifications** triggered by motion or specific species.
- ✓ **Benefit:** Enables immediate response to important events like poaching, large predators, or human intrusions.

➤ **Sensor Fusion (Temperature, Sound, Humidity)**

- ✓ **Improvement:** Add **DHT11/22 (temperature/humidity), microphone, or sound sensors** to collect environmental data.
- ✓ **Benefit:** Provides **contextual insights** into wildlife activity patterns, like sound-based detection or time-of-day behavior.

References:

- [1] Dr. KOMMU NAVEEN, Dr. R.M.S PARVATHI, on "A Review of Deep Learning Applications for Speech Processing Improvement & Applications" "Journal of Telecommunication, Switching Systems and Networks (JOTSSN)" | ISSN: 2454-637, p-ISSN: 2455-638 | www.jotssn.com | Impact Factor: 7.569 | | Volume 9, Issue 2, September 2022 | | DOI: DOI (Journal): 10.37591/JoTSSN/|http://engineeringjournals.stmjournals.in/index.php/JoTSSN/index
- [2] Dr. KOMMU NAVEEN, Dr. R.M.S Parvathi, on "A Comprehensive Review On Machine Learning Applications of Convolutional Neural Networks to Medical Image Analysis" at 'International Conference on Robotics and Communication Technology-ICRCT-2022' Page No: 50-57, ISSN : 2708-1079; IC Value: 45.98; Impact Factor: 7.379; VOLUME-03, ISSUE-1; 4th January, 2022. URL:https://doi.org/10.46379/jscer.2022.030104
- [3] Hatice Cinar Akakin and Metin N. Gurcan, "Content Based Microscopic Image Retrieval System for Multi-Image Queries", IEEE Transactions On Information Technology In Biomedicine, VOL. 16, NO. 4, JULY 2012
- [4] Yong-Hwan Lee and Sang-Burm Rhee, Bonam Kim, "Content- based Image Retrieval Using Wavelet Spatial-Color and Gabor Normalized Texture in Multi-resolution Database", 978-0- 7695- 4684-1/12 \$26.00 © 2012 IEEE, DOI 10.1109/IMIS.2012.98
- [5] Dr. KOMMU NAVEEN, Dr. R.M.S Parvathi, on "Contract and Feature Extraction of CBIR Method Using Soft Computing Techniques in Machine Learning" at 'Journal of Instrumentation Technology and Innovations' Page No: 17-27; ISSN (PRINT): 2249-4731; ISSN (ONLINE): 2347-7261 VOLUME-12; ISSUE-01; April-May -2022. DOI(journal):10.37591/JoITI, URL: http://www.engineeringjournals.stmjournals.in/index.php/JoITI/index.
- [6] S. Mangijao Singh , K. Hemachandran , "Content-Based Image Retrieval using Color Moment and Gabor Texture Feature", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 5, No 1, September 2012; ISSN (Online): 1694- 0814
- [7] Dr. K. Naveen Kumar, Dr. M. B. Raju, Prof. A. Sridhar, IJRAR August 2024, Volume 11, Issue 3 www.ijrar.org (E-ISSN 2348-1269, P- ISSN 2349-5138) IJRAR24C2120 , International Journal of Research and Analytical Reviews (IJRAR) 2024 IJRAR August 2024, Volume 11, Issue 3 www.ijrar.org (E-ISSN 2348-1269, P- ISSN 2349-5138).
- [8] Kanchan Saxena, Vineet Richaria, Vijay Trivedi, "A Survey on Content Based Image Retrieval using BDIP, BVLC AND DCD", Journal of Global Research in Computer Science , Vol.3, No. 9, September 2012 ,ISSN-2229-371X.
- [9] Dr. K. Naveen Kumar, Dr. M. B. Raju, Prof. A. Sridhar on International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 12 Issue VIII Aug 2024- Available at www.ijraset.com.
- 10) Dr. KOMMU NAVEEN, Dr. R.M.S Parvathi, on "A Review On Content Based Image Retrieval Systems Features derived by Deep Learning Models" at 'International Journal For Research In Applied Science And Engineering Technology (IJRASET)' Page No: 42-57, ISSN : 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429; VOLUME-09, ISSUE-XII; November- 2021. URL:www.ijraset.com/index.html/doi.org.