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Human Activity Recognition

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Abstract: Recognizing human activity is important for interpersonal interactions and human-to-human communication. Since it provides information on a person's identity, personality, and psychological condition, it is difficult to extract. Multiple activity detection systems are now required in a variety of applications, including robotics for defining human behaviour, human-computer interaction, and video surveillance systems. To do this, we'll combine the OpenCV model with the ML algorithm(like CNN). The developed model will finally be integrated with a website that will use the webcam and provide the result of the activity being performed accurately.

Keywords: Convolutional Neural Network (CNN) ,Human activities recognition (HAR)

I. INTRODUCTION

"Human Activity Recognition" is a subject that has grown in significance over the last few decades in the fields of artificial intelligence and computer vision. The notions of human activity recognition aid in comprehending the concepts and problems of human action understanding, which greatly aids in medication, management, learning styles, and many circumstances involving video retrievals. Running, playing, resting, eating, and many more physical activities can be recognized by the Human Activity Recognition Systems (HAR). Simple, sophisticated activities are both included in recognition of human activity. There is relatively little research on identifying complicated human activities, such as cleaning one's teeth, dribbling a ball, etc. Complex human activities require completing a simple human activity together with a particular transition action.

HAR employing labeled data is a multivariate time series classification and supervised learning challenge in the domain of machine learning. Previous research has examined the problem of recognizing activity using both conventional deep learning methods like ANN, CNN, RNN, and LSTM as well as nonconventional deep learning algorithms like SVM, and Random Forest. Traditional techniques have the drawback of requiring human feature extraction and feature engineering, which takes time. Machine learning algorithms, on the other hand, are more suited for the task of identifying complicated human behaviors since they can automatically learn the features from the data We will be developing a machine-learning model which will be able to recognize the activities performed by humans accurately and also to detect any suspicious activities performed. A website will be built around a model to view the predictions made by the model.

II. LITERATURE REVIEW

R. Bhardwaj, S. Kumar and S. C. Gupta: In this paper, the author tries to recognize human activities using Kmeans clustering even pruning is used. The drawbacks of past techniques was when complex backgrounds were present it was difficult to extract activities. Pruning overcomes this problem by extracting the activities from complex backgrounds. With the help of K-means clustering similar actions of different humans like running, jumping, walking and hand movements in different ways are identified and clustered together from the videos. In the paper, the data collected from smartphone is multi channel motion and is also structured in new way and finally converted to a virtual image.

An application software of IOS was developed by the author to stream and record motion data to recognize real time activities. The data of an gyroscope and accelerometer motion sensors are structured into a virtual image. T. R. Rahman, M. Atikuzzaman, M. Z. Islam ,E. Wazed, M. P. Hossain: The author focused on CCTV images and videos to detect activities of humans using Haar Feature based Classifier to recognize human activity using the convoluted neural network Classifier. Authors Human Activity Recognition System was being trained using the collected dataset composed of images. This approach was accomplished an efficacious detection and recognition with good accuracy.

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SYSTEM ARCHITECTURE

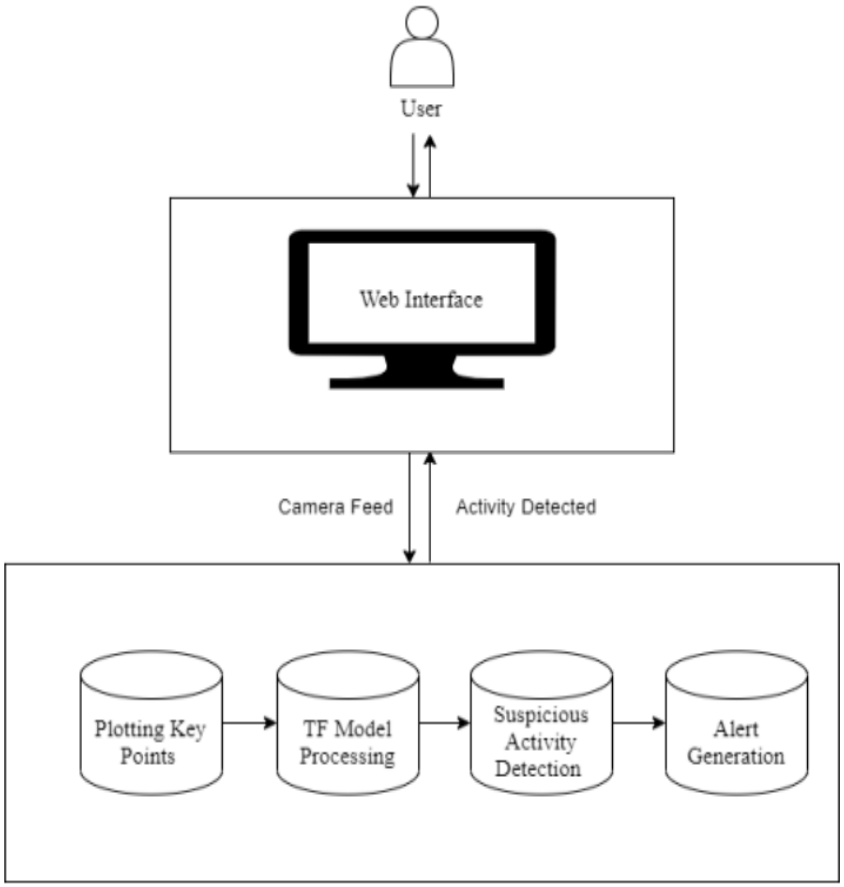

Fig 1: Human activity architecture

The figure 1 illustrates the human activity architecture. The action performed by the user is shown in the architectural format where the webcam uses camera and plots the key points later processes the TF model, if the suspicious activity id detected, the alert is generated by providing a beep sound. This makes easy to find the suspicious activity.

III. PROPOSED METHODOLOGY

Data Collection: Collect video data of human activities, including both normal and suspicious activities. Use a camera or other suitable video recording device to capture the data. Data pre-processing: Split the video data into individual frames and extract the images from each frame. By dividing the data into training and testing sets and labelling each image with the activity being performed, the data is prepared for training and testing. Pose Estimation: Use the TensorFlow Pose Estimation model to detect and track the poses of the humans in each image. This will produce a set of keypoints for each pose in each image. Model Training: Using the features extrapolated from the training data, train a machine learning model, such as a neural network. Employ a suitable algorithm, such as supervised learning, to train the model to detect normal and suspicious actions based on the extracted attributes. Feature Extraction: To extract important details from poses, such as joint angles, body positions, and movements, use the key points. The model will be trained to differentiate between normal and suspicious activity using these features.

IV. OBJECTIVES

- To develop a system that accepts videos as input.
- To design a replica which will be able to recognize the actions being performed by using ML and OpenCV modules.
- To integrate the developed model into the website and display the detections.

This project aims to train and transform an ML model to identify the activity being performed. To acquire a dataset that is perfectly labelled to train the model. To be able to classify the performed actions like walking, jogging, etc. accurately

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and also to be able to generate alerts on suspicious activity detection. This web application will take the input as video and identifies only the activities which are trained for the model. When the suspicious activities are found an beep sound is generated to alert a person. The Data Flow Diagram is diagrammatically shown below. There are 3 levels which makes us easy to form the flowchart, the below figures shows how the user can easily find if any suspicious activity is formed, these steps are made easier by creating a flowchart as shown in figure.

V. DESIGN

A. USE CASE DIAGRAM

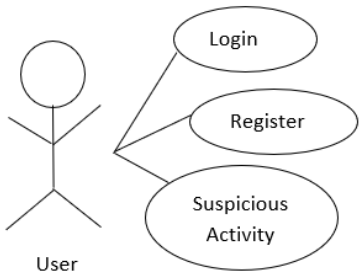

Fig 2: Use case diagram

B. DATA FLOW DIAGRAM

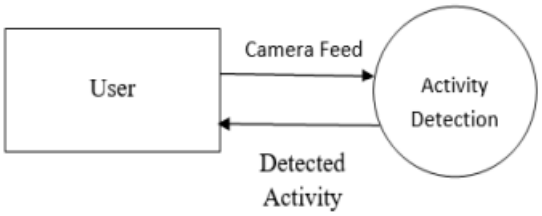

Fig 3.1: Level 0

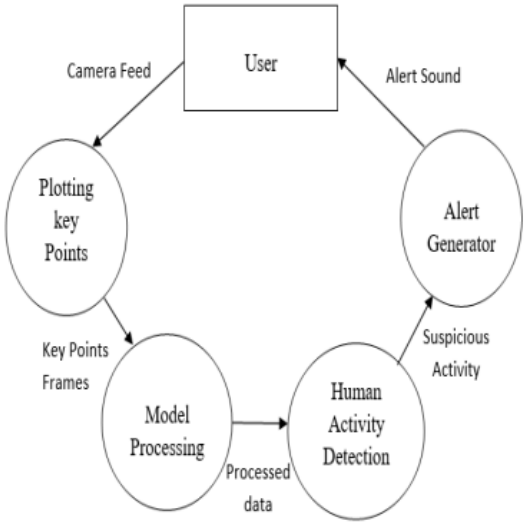

Fig 3.2 : Level 1

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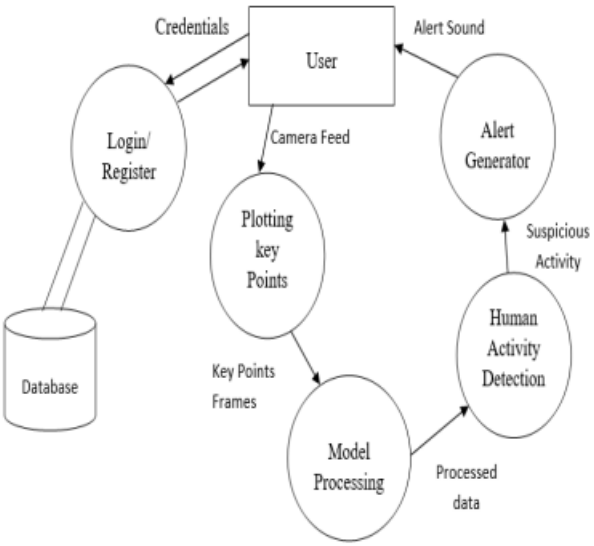

Fig 3.3: Level 2

C. FLOWCHART

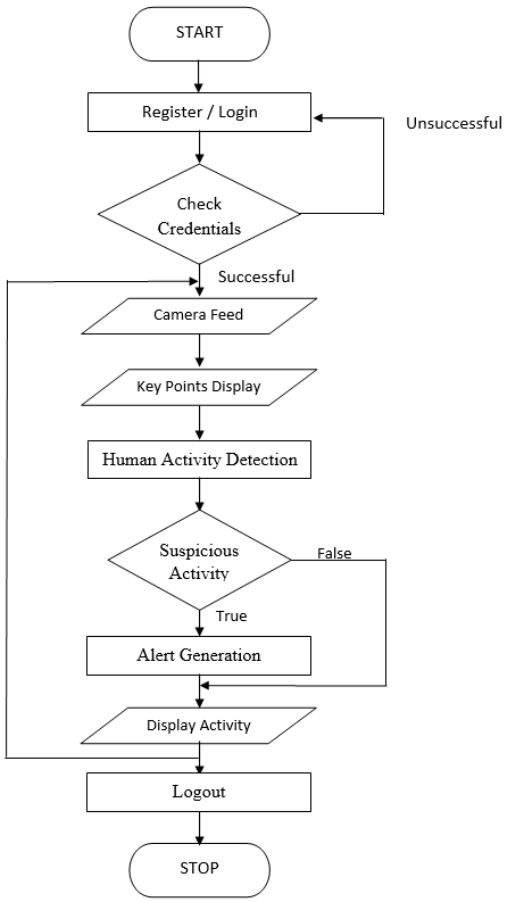

Fig 4 : Flowchart

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D. SEQUENCE DIAGRAM

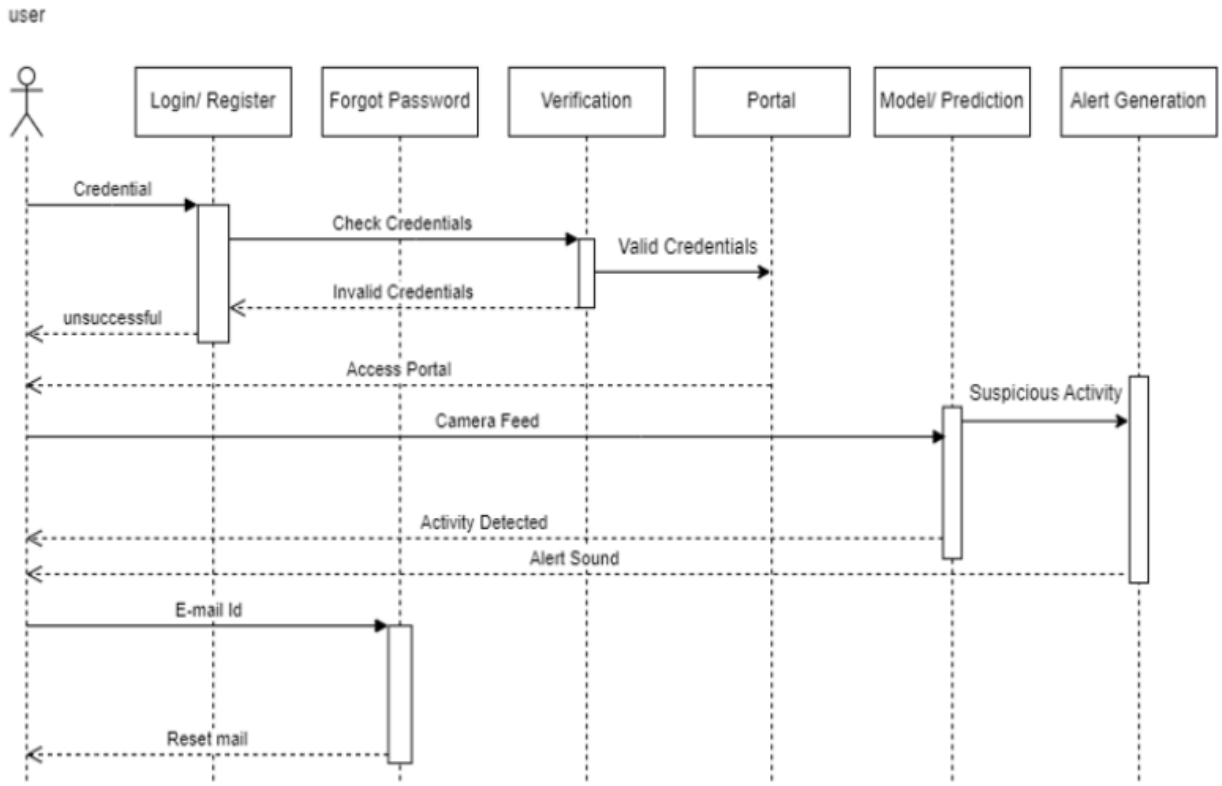

Fig 5: Sequence Diagram

This model is performed by 6 steps.The user follows the credentials , if they are valid the data is sent to portal .The credentials found are invalid,it responds user unsuccessful. User access the data from camera and if it is found to be suspicious, then the activity is detected and alert sound is produced.

VI. DESCRIPTION OF MODULES

1. *Key Points Detection:* In this module, when the user tries to perform some activity the joints are identified and key points are been displayed on the screen above the live camera display.
2. *Alert Generation:* In this module, when suspicious activity is detected in the camera a sound is generated to alert the user.
3. *Login:* In this module, users are able to access the site by providing registered credentials.
4. *Register:* In this module, users are able to create an account on the website by giving a valid mail id and password.

VII. IMPLEMENTATION

Collecting data is the first step in putting the Suspicious Human Activity estimation model into practice. This includes gathering pictures or videos of individuals engaging in various activities. The information must be varied and cover a wide range of activities. We have collected the datasets from kaggle.com for fighting and gun activities. The next step is to annotate the data. This involves identifying key points in the human body such as joints, limbs, and head. The TensorFlow pose estimation model needs to be trained after data gathering. This includes using the data to train the model to recognize important body parts and distinguish between various activities. After training, the TensorFlow pose estimation model is stored as a pickle file and included on the website.

1. PROGRAMING LANGUAGE SELECTION

Python is a great choice for implementing a suspicious human activity detection project because of its simplicity, ease of use, and versatility. Python offers a wide range of powerful libraries and tools such as OpenCV, TensorFlow, and Keras, that can be used to build complex image and video processing applications. These libraries provide access to pre-trained

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models for object detection and pose estimation, which can be fine-tuned for specific applications such as detecting suspicious human activity. Additionally, Python's rich ecosystem of data visualization and analysis libraries such as Matplotlib and Pandas can be used to analyze and visualize the data obtained from the detection process. Furthermore, Python's extensive documentation and active community make it easy to get help and find resources when developing a suspicious human activity detection project. Overall, Python's simplicity, versatility, and powerful libraries make it an excellent choice for implementing a suspicious human activity detection project.

2. SELECTION OF PLATFORM

The project is developed as a website as they would only require an internet connection and browser to access the website.

VIII. TESTING

A. TESTING PROCESS

The process of developing software includes testing. In a sense, the testing procedure validates whether the developed product complies with the standards that it was intended to. The creation of test cases, against which the product must be tested, is a step in the testing process. In some instances, test cases are created using the system specifications listed for the product or software that is being developed.

B. TESTING OBJECTIVES

The main objectives of the testing process are as follows:
Testing is a process of executing a program with the intent of finding an error.
A good test case is one that has high probability of finding an as yet undiscovered error.
A successful test is one that uncovers an as yet undiscovered error.

C. LEVELS OF TESTING

Different levels of testing are used in the testing process; each level of testing aims to test different aspects of the system. The basic levels are unit testing, integration testing, system testing and acceptance testing

1. UNIT TESTING

Unit testing focuses verification effort on the smallest unit of software design the module. The software built is a collection of individual modules. In this kind of testing the exact flow of control for each module was verified. With detailed design considerations used as a guide, important control paths are tested to uncover errors within the boundary of the module.

TABLE 1: UNIT TESTING

Module	**Input**	**Expected Output**	**Actual Output**
Email Id Verification	Email Id	To generate links and validate the account	Generates the link and validates the account
Forgot Password	Registered Email Id	To generate and send a password reset link	Password reset link is generated and sent
Alert Generation	Camera Feed	To generate an alert sound after detecting suspicious activity	Generates an alert after detecting suspicious activity

2. INTEGRATION TESTING

The second level of testing is called integration testing. In this, many class-tested modules are combined into subsystems, which are then tested. The goal here is to see if all the modules can be integrated properly. We have identified and debugged.

TABLE 2: INTEGRATION TESTING

Module	**Input**	**Expected Output**	**Actual Output**
Registration	Email Id Password	Register User if the mail id is valid	User registration successful
Login	Email Id Password	Login into the system if the credentials are valid and error message if the credentials are invalid	Successfully login into the system if credentials are valid else error messages are shown

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3. SYSTEM TESTING

Here the entire application is tested. The reference document for this process is the requirement document, and the goal is to see IF the application meets its requirements. Each module and component of ethereal was thoroughly tested to remove bugs through a system testing strategy. Test cases were generated for all possible input sequences and the output was verified for its correctness.

TABLE 3: SYSTEM TESTING

Steps	**Action**	**Expected Output**
Register	Provide valid details and register	Register the user successfully if valid details are provided
Login	Enter valid credentials and login into the system	If entered credentials are valid user logs in to the system
Suspicious activity detection	Live camera feed	Detect and generate an alert when suspicious activity is detected

IX. CONCLUSION

The model built is able to predict the actions performed by the human accurately. We are using inputs as webcam feed to the machine learning model. The best-performing model based on accuracy will be integrated into the web interface using the flask framework. On detection of suspicious activity, an alert Sound is generated to notify the users.

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