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A Proposed Sleep Walking Monitoring System using Image Mining

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ABSTRACT: Image mining has become a topic of interest in recent years and its development has lead to increasing growth in detailed and extensively large image databases. Face recognition has recently gained important attention as one of the applications of image processing and analysis in last few years. Though tracking and recognizing face objects is a regular task, its applications in the medical field is still an active research. Facial gestures are a key modality for augmentative and alternative communication in patients suffering from speech impairments and full-body paralysis. Somnambulism, more commonly known as sleep walking, is a sleep disorder that can lead to various dangerous consequences. There is no direct cure for this disorder that can assure the patients health. To address these problems, we propose an image based monitoring system that will continuously monitor the patient using a camera and apply image mining techniques to recognize the gestures or facial expressions and then notify the caretaker or doctor immediately.

KEYWORDS: Image analysis, Image based monitoring system, Motion detection, Pattern recognition

I. INTRODUCTION

Image mining is an interdisciplinary endeavour that draws upon expertise in various fields like computer vision, image retrieval, matching and pattern recognition. Image mining draws basic principles from concepts in databases, machine learning, statistics, pattern recognition and 'soft' computing [10]. This principle of image mining can be used to design sleep walkers monitoring system. Sleepwalking, also called somnambulism, is a behavioural disorder that originates during slow wave sleep stage and results in walking or performing other activities while asleep. It is occurs more commonly in children than in adults and is more likely to occur in a sleep deprived person. Since a sleepwalker typically remains in the deepest stage of dreamless sleep, it is difficult to wake the person and the person will probably not remember the activities done during sleepwalking.

Sleepwalking is a series of complex behaviours that are carried out in the deepest stage of sleeping, the most obvious behaviour is walking. Symptoms of this disorder may be sitting up in bed and looking around, walking around the room or house, leaving the house and even driving vehicles. A sleepwalker should not be awakened has been a common misconception among the people. In fact, if the sleepwalker is not awakened, it can lead to serious accidents [9].

The main purpose is to design a system for mining the images of Sleep Walker and notify them using alarm and if they do not respond, then notify the caretaker using Android app.

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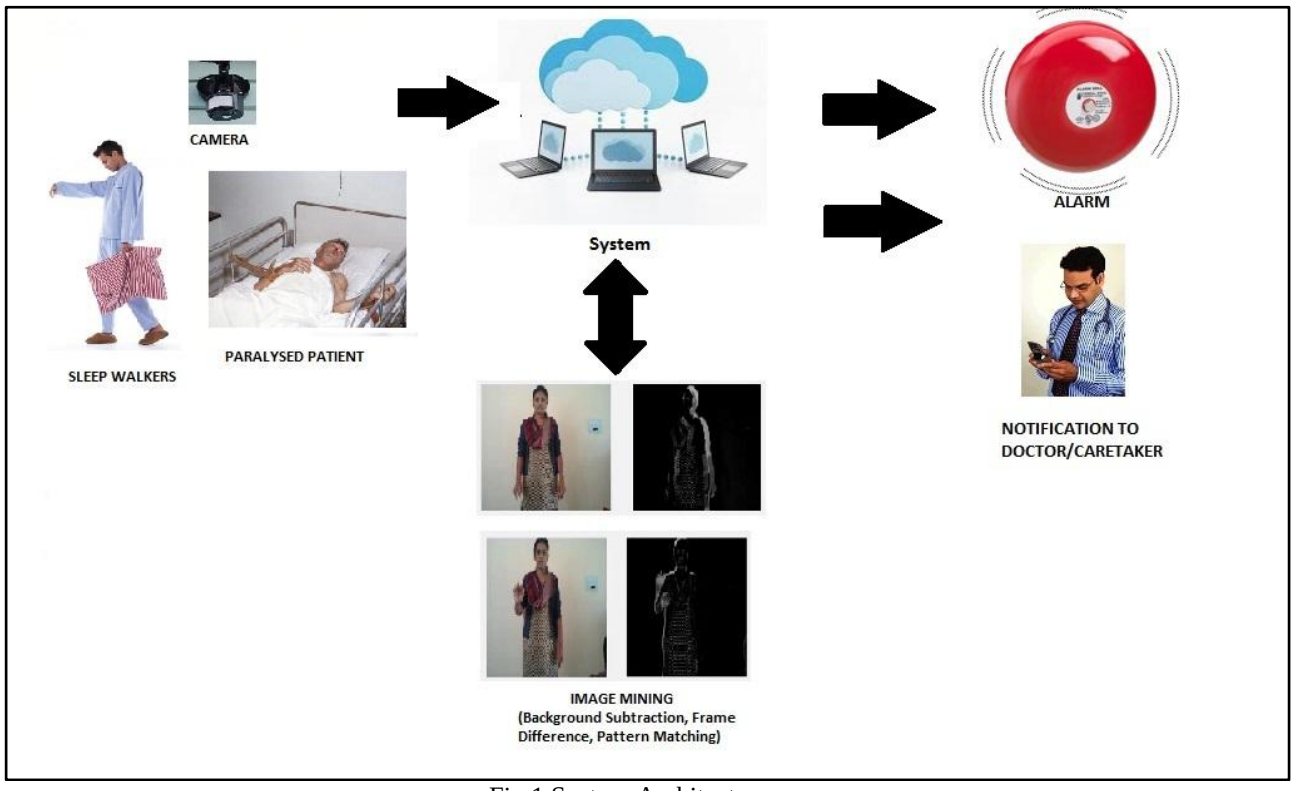

Fig.1 System Architecture

II. RELATED WORK

In [1], the author has shown that the amount of children having sleep disorders that cause movements during sleep is increasing. The cause of this disorder is Attention-deficit hyperactivity disorder (ADHD). There frequent body movement during sleep in ADHD affected children. Thus, a new device that can diagnose children with ADHD using video images and processing them was created. In [2], the author has explains about cluster based image retrieval system. Image retrieval is the basic requirement task in image mining. Content Based Image Retrieval is the popular image retrieval system. In this method, the target image is retrieved based on the useful features of the given image. The authors have proposed a new clustering technique by combining concepts of CBIR and Image mining in order to increase the speed of the image retrieval system. In their system, clustering is done based on RGB Components, entropy classification and Fuzzy C means algorithm. Facial neuromuscular dysfunction has a severe impact on adaptive and expressive behaviour of the person and his/her emotional health. In this paper [4], the authors created an automated face analysis (AFA) method for quantifying facial motion, and compared it with the Maximal Static Response Assay (MSRA), an existing manual marking method. Face recognition has recently gained important attention as one of the applications of image processing and analysis in last few years. Though tracking and recognising face objects is a regular task, it is still an active research to build such a system. In [5], the authors have surveyed and compared various image mining techniques. In [7], the present motion in an area of environment being monitored. The motion is detected on the basis of background subtraction and frame differencing.

III. IMAGE MINING TECHNIQUES

Image mining deals with the extraction of image data relationship, implicit knowledge, or other patterns which are not explicitly stored from the computer vision and image processing techniques, i.e. image mining focuses on the extraction of patterns from large collections of images [11]. Image mining is one in which, it involves general application where the focus is on the process of generating image patterns that help to understand the interaction between high-level human perception of images and low-level features.

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There are various methods which allow image mining to have different approaches. First method extracts images from databases or collection of images or videos. Second method mines the combination of associated alphanumeric data and collection of images. Image mining applications can be broadly classified as:

1) Domain specific
2) General

Both are used to extract most relevant image feature and later to generate image patterns. Various steps involved while mining an image are:

1. Get image from databases
2. Image pre-processing
3. Feature extraction
4. Data to be mined
5. Evaluation of result

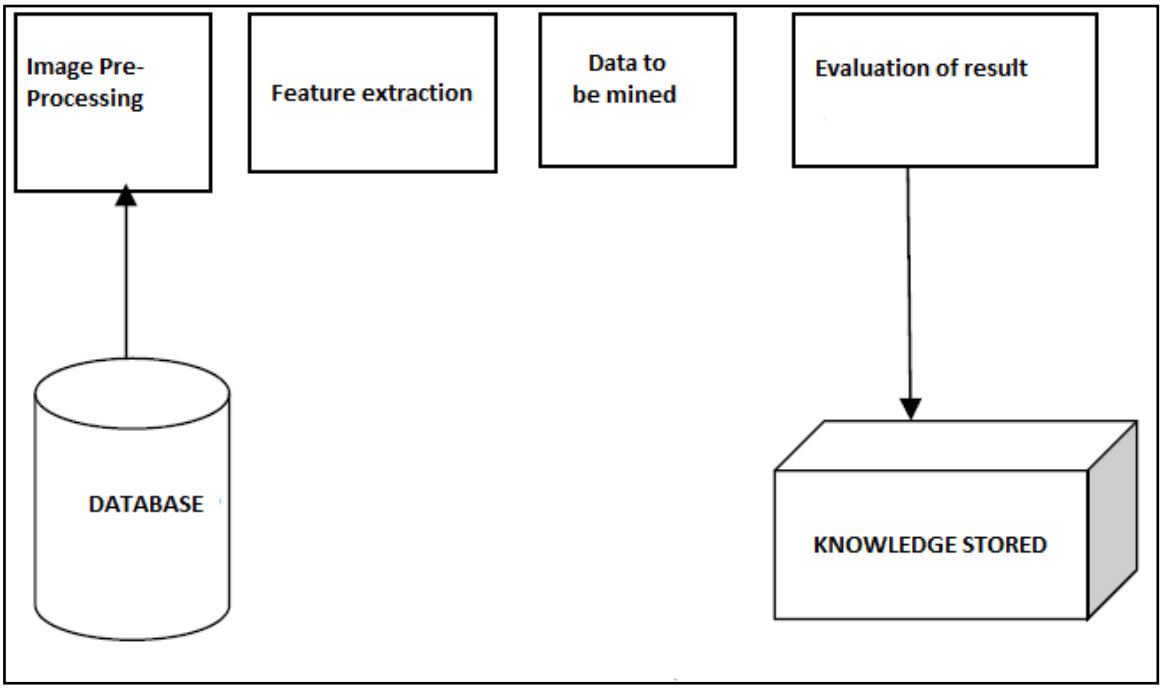

Fig.2 Image Mining Process

IV. PROPOSED SYSTEM

A. Design Considerations:

- Maintains Database:
  1. Patients Information
  2. Caretakers Information
  3. Storage of information on local cloud

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- Image Capturing:
  1. High Quality camera is used
  2. Real-time monitoring of patients
  3. Get accelerometer values
  4. Movement of patient is captured

- Pattern Recognition:
  1. Images are mined
  2. Mined images are compared with previous data stored
  3. Captured images are recorded
  4. Gesture recognition

- Send Notification:
  1. Ring alarm for patient
  2. Notify caretaker if patient does not respond

B. *Working Principle:*

Motion detection and tracking will be the basic principle for the implementation of designed system. Difference between two frames of images will be used to detect motion. Current image known as mask image will be compared with other frames of image and the difference between these two frames will be the motion detected.

Let I be the stream of images that is to be captured by cameras.

$$I = I_1 + I_2 + I_3 + \ldots + I_n$$

Where, I = Stream of images

$I_1 + I_2 + ... + I_n$ = Frames of images

Let M be the motion we detect with n number of frames of image.

$$M = M_1 + M_2 + M_3 + \ldots + M_n$$

Where, $M_1 = | I_2 - I_1 |$

$M_2 = | I_3 - I_2 |$

…….

…….

$M_n = | I_n - (I_n\text{-}1) |$

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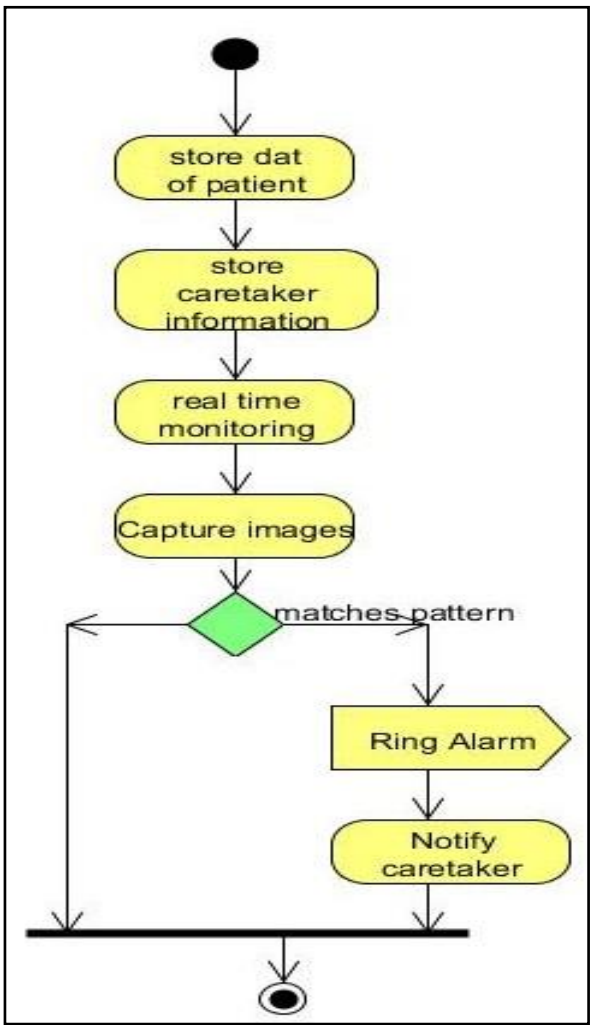

Fig.3 Flowchart

V. MATHEMATICS RELEVANT TO OUR SYSTEM

Inputs: Video images of sleep walker and paralysed patient.

I = {D, Q, AI}
D = {D1, D2, D3...| D gives dataset}
Q = {Q1, Q2, Q3.... | Q gives camera feed}
AI = {AI1, AI2, AI3… | AI Accelerometer value}

Outputs:

1. Alarm till the sleep walker responds to it and if no response then notify the caretaker.
2. Notify the nurse/ caretaker about the movement of the paralysed patient.

O = {AM, NT}
AL = {AM1, AM2, AM3… | AM gives the Alarm set or not}
NT = {NT1, NT2, NT3…. | NT gives the Notification}

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Identify data structures, classes, divide and conquer strategies to exploit distributed/parallel/concurrent processing, constraints.

Functions: Identify Objects, Morphisms, Overloading in functions, Functional relations

F = {F1(), F2(), F3(), F4(), F5(), F6()}
F1 (D):: maintain data set
F2 (Q):: get camera feed
F3 (D, Q):: image mining
F4 (AI):: get accelerometer value
F5 (AI, Q):: detect sleep-walking/paralytic patient gestures
F6 (Q):: set alarm/ send notification

Success Conditions:

S = {Sleep-walker, Caretaker Notified Successfully}

Failure Conditions:

Fa = {Failed to Notify the Sleep-walkers or Caretaker}

VI. SOFTWARE AND HARDWARE REQUIREMENTS OF OUR PROJECT

1. **IDE:**
   Eclipse: Eclipse is an open source IDE available to support a variety of languages. It is free and open-source software.
   Android Studio: Official IDE for Android Application Development. It is drag and drop theme editor. Build variant and multiple apk file generation.

2. **Programming Languages:**
   JAVA, R Programming

3. **Hardware:**
   High Quality Camera

VII. CONCLUSION AND FUTURE SCOPE

In our paper, a completely new approach is proposed to develop system to monitor sleep walkers using image mining. It helps in extracting the required meaningful information from images in database. This information can be used in various applications. This system will helps other people i.e. caretaker or other family members to take care of the sleep-walker once detected. System will be beneficial in order to prevent injuries and other fatalities due to sleep walking. This paper helps us to know different image mining techniques which can be used in future. In future we can also develop a system for real time monitoring of patients in smart-hospital.

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