VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi-590018, Karnataka

A **Project Phase - II** Report on

"PATIENT IDENTIFICATION BASED ON FACIAL RECOGNITION USING LBPH ALGORITHM"

Submitted in fulfillment for the requirements of VIII semester degree of

BACHELOR OF ENGINEERING

IN

INFORMATION SCIENCE AND ENGINEERING

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2021-22

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CERTIFICATE

Certified that the Project on topic **"PATIENT IDENTIFICATION BASED ON FACIAL RECOGNITION USING LBPH ALGORITHM"** has been successfully presented at **Don Bosco Institute of Technology** by **POOJITH S (1DB18IS058),** in partial fulfillment of the requirements for the VIII Semester degree of **Bachelor of Engineering in Information Science and Engineering** of Visvesvaraya Technological University, Belagavi during academic year 2021-22. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The Project report has been approved as it satisfies the academic requirements in respect of Project work for the said degree.

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EXTERNAL VIVA

Name of the Examiners	Signature with Date
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ACKNOWLEDGMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crowned the efforts with success.

I would like to profoundly thank **Management** of **Don Bosco Institute of Technology** for providing such a healthy environment for the successful completion of Project work.

I would like to express my thanks to the **Prof. Umashankar B.S,** Principal for their encouragement that motivated me for the successful completion of Project work.

It gives me immense pleasure to thank **Dr. B K Raghavendra,** Professor and Head of Department for his constant support and encouragement.

Also, I would like to express my deepest sense of gratitude to **Prof. Shridevi Sali**, Assistant Professor, and Department of Information Science & Engineering for the constant support and guidance throughout the Project work.

I would also like to thank all other teaching and non-teaching staff of Information Science Department who has directly or indirectly helped me in the completion of the Project work.

ABSTRACT

Our system is designed to help paramedic or hospital staff when they come across an unresponsive or non- communicative patients, identifying these patients can be a challenging and time consuming. So here our system named patient identification based on facial recognition can be an alternative to identify the patient, by using this I not only identify the patient but also can used to access his/her previous medical records and emergency details. To achieve this, we use facial recognition technique to identify patients and to gather the medical information we use database in which data is stored earlier. To perform face recognition, we use traditional methods namely Haar cascade to detect faces and LBPH (Local Binary Patter Histogram) to extract facial features and to find the encodings. The found encodings and encodings stored in database is compared if it gets matched the patient's previous medical records and emergency details will be displayed.

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Chapter 1

INTRODUCTION

Facial Recognition is a method or technology used to recognize or identify an individual in a digital picture or video, as human we identify people effortlessly the same task can very hard for a machine to identify and map the individual in an image to real person. Now imagine how hard is to identify a person we never knew, that too when that person is unresponsive and uncommunicative.

Face recognition systems use computer algorithms to pick out specific, distinctive details about a person's face. These details, such as distance between the eyes or shape of the chin, are then converted into a mathematical representation and compared to data on other faces collected in a face recognition database. The data about a particular face is often called a face template and is distinct from a photograph because it's designed to only include certain details that can be used to distinguish one face from another.

So, our system "Patient Identification Based on Facial Recognition Using LBPH Algorithm" is designed to be as an alternative to identify the patients who are unresponsive and who are in non-communicative state. In our model we mainly focus on Identifying the Patients who all are already registered or who whose face data is available to us in prior. As Mentioned in References [2][4][9] these authors suggest LBPH algorithm gives us the higher accuracy at low lighting and low resolution since it is relatively dependent on intensity of light. So, we suggest Face recognition is not only restricted to authorization/authentication of the users for security purpose but the face recognition technology can also be utilized in medical field for Identifying the unresponsive patients. Using this technology, we can access their records/file faster than current system, even [1] this paper suggests the same.

1.1 Problem Statement

According to WHO the standards/policies suggest to use at least 2 methods to confirm patient identity to avoid any medical error and give the patients right care. Our system is used as an alternative to identify those patients and we can retrieve the data fast and easy.

1.2 Aims and Objectives

- To design a model for Facial recognition for patient identification.
- To design a system for Face Detection and Recognition using machine learning.
- To design a system which detects the patient face and shows his/her information.

1.3 Motivation

People in developing and underdeveloped economies face medical emergencies on a daily basis. Due to a variety of factors, including the delivery of medical treatment when the patient is uncommunicative or unresponsive, some of these medical emergencies end tragically for many people in these countries. The ability of attending medical personnel to access a patient's medical history is critical to the treatment quality. Unfortunately, many lives are lost in low-income economies today due to a lack of or inaccessibility to a patient's medical information during medical emergencies. The lack of dependable and cost-effective healthcare delivery systems that support patient identification and verification is one of the major contributing factors to the lack of records. Due to the widespread availability of mobile devices with built-in digital cameras, this paper investigates the feasibility and practicality of using facial recognition software and deploy a low-cost system for accurate patient identification and verification.

1.4 Existing System

In this System, an implementable idea of using the advanced Computer Vision Technology to eliminate printed prescriptions and physical components like RFID, Record Files has been proposed. The results of having a Universal Medical Face Identification for every patient have been properly showcased that take several factors into consideration like reducing the inefficiency, amount of time taken at reception and efforts of medical staff in recognizing a patient and drawing out subtleties of the patient's medical history, previous visits to the specialist, and prescriptions. A database linked to the patient's face image can be deployed on a secure platform that can be updated from time to time and will be universally considered as the basis of the identity of patients available to the doctors at all certified medical centers for studying and taking immediate action. Facial recognition can be utilized in hospitals for staff and patient tracking efficiently and practically faster than the current record-based approach. Finally, the comparison of wait time and technical challenges of current methods, implementation and privacy are highlighted.

Considering the following issues, the existing system has the following disadvantages:

- The Accuracy of returning the correct person record was low when under low lighting condition.
- The system did not provide any kind of protection to uses data i.e., patient data privacy is very important.

1.5 Proposed System

To resolve this problem, we use traditional methods namely Haar cascade to detect faces and LBPH (Local Binary Patter Histogram) to extract facial features and to find the encodings. The found encodings and encodings stored in database is compared if it gets matched the patient's previous medical records and emergency details will be displayed. And we also provide a login System so only authorized people can access the Patients data.

Advantages of proposed system are:

- The main advantage includes high processing speed and high classification accuracy.
- The algorithm used gives use the higher accuracy even under low light condition which was the major drawback of previous system.
- The algorithm that we used is most robust technique for image classification.

The Figure 1.1 shows the block diagram of our proposed System and methodology.

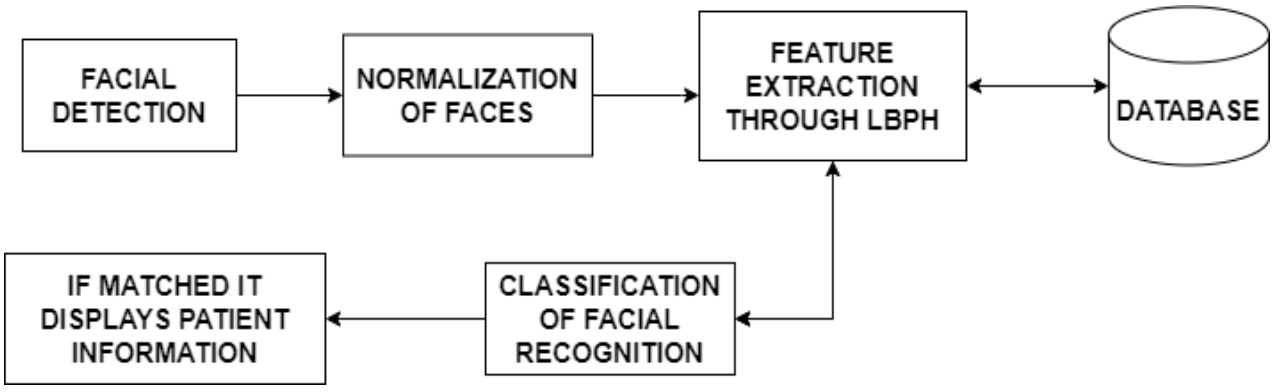

Figure 1.1 Block Diagram of Proposed System

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Chapter 2

LITERATURE SURVEY

1. Patient Identification Using Facial Recognition

Author: Vinay Kumar Verma, Vanika Kansal & Pankhuri Bhatnagar

In this paper, an implementable idea of using the advanced Computer Vision Technology to eliminate printed prescriptions and physical components like RFID, Record Files has been proposed. The results of having a Universal Medical Face Identification for every patient have been properly showcased that take several factors into consideration like reducing the inefficiency, amount of time taken at reception and efforts of medical staff in recognizing a patient and drawing out subtleties of the patient's medical history, previous visits to the specialist, and prescriptions. A database linked to the patient's face image can be deployed on a secure platform that can be updated from time to time and will be universally considered as the basis of the identity of patients available to the doctors at all certified medical centers for studying and taking immediate action. Facial recognition can be utilized in hospitals for staff and patient tracking efficiently and practically faster than the current record-based approach. Finally, the comparison of wait time and technical challenges of current methods, implementation and privacy are highlighted**.**

2. LBPH Based Improved Face Recognition at Low Resolution

Author: Ahmed, Aftab; Guo, Jiandong; Ali, Fayaz; Deeba, Farha; Ahmed, Awais

This paper uses the Local Binary Patterns Histogram (LBPH) algorithm architecture to address the human face recognition in real time at the low level of resolution. This system operates better at the minimum low resolution of 35px to identify the human face in various angles, side poses and tracking the face during human motion. They have designed the dataset (LR500) for training and classification. The results were 90% efficient for face recognition using above algorithm.

3. Face Description with Local Binary Patterns: Application to Face Recognition

Author: Timo Ahonen, Student Member, IEEE, Abdenour Hadid, and Matti Pietika¨inen,

This paper presents a novel and efficient facial image representation based on local binary pattern (LBP) texture features. The face image is divided into several regions from which the LBP feature distributions are extracted and concatenated into an enhanced feature vector to be used as a face descriptor. The performance of this proposed method is assessed in the face recognition problem under different challenges. This paper compares the recognition rates of LBP and other comparison algorithm, it shows that LBP has more efficient than another algorithm such as PCA, Bayesian, EBGM. Below figure 2.1 shows Local Binary Pattern Extraction

4. Face Recognition Based on Lbph and Regression of Local Binary Features

Author: Gao Xiang1, Zhu Qiuyu1, Wang Hui1, and Chen Yan

In this paper the authors Gao Xiang1, Zhu Qiuyu1, Wang Hui1, and Chen Yan, presents a system to recognize face by a variation of LBPH. The authors use a method of regression of local binary features to get the landmark of face image whose computational complexity is very low. They utilize these landmark points which can be trained to align the face, to extract the facial features. By calculating the Local Binary Patterns Histogram (LBPH) of these landmark points and its neighborhood pixels, they can extract effective facial feature for face recognition. This method can increase the calculating speed of LBPH and also can improve the recognition rate. they show the experimental results using this method to recognize face.

5. Multi-Faces Recognition Process Using Haar Cascades and Eigen face methods

Author: Teddy Mantoro, Media A. Ayu and Suhendi

This paper is proposed by Teddy Mantoro, Media A. Ayu and Suhendi which provides the faster solution for face recognition with better result. Face recognition in this system is done using the Haar Cascades and Eigenface methods where it recognizes the multiple faces in the single detection with accuracy of 91.67% with this system.

6. Iot Based Smart Health Monitoring System with Patient Identification Using Face Recognition

Author: Kanubhai K. Patela, Jignesh J. Patoliyab & Miral M.

In this paper, authors proposed smart health monitoring system which reduces human effort, gives accurate and quick result. They proposed system which is implemented using efficient method of face recognition of patients. New case for a first-time patient generated and registered in the database using face recognition. During the regular check-up of the patients, the database will be updated. The database is maintained on to the cloud with the prototype Health board, it consists of Graphical User Interface (GUI) which allows registration of new case by face recognition of patient and default parameters like pulse rate, blood pressure etc. are noted and updated on the database. The default health parameters measured using sensor which are interface with IoT Module. Here ESP-32 is used as an Internet of Things (IoT) module. Health board GUI is designed using python. The technology used in this paper for Face recognition algorithm are Open Vision Computer (OpenCV) library and Amazon DynamoDB is used as a cloud.

7. Face Recognition-Based Automatic Hospital Admission with SMS Alerts

Author: Mamata Parab & Ninad

In this paper the authors Ninad Mehendale, Mamata Parab proposed an automated system which can fill the forms with the help of face recognition. For this the authors have used a facial vector-based algorithm and also, they demonstrated sending SMS o the concern police and even to the relatives of the patient automatically using GSM modules. All the patient records are stored in the database which can be accessed by hospital using internet. This paper helped in treatment of the patient because of the medical history was auto-filled even in the case of an unconscious patient. After testing on 51 real-time patient images and found that the accuracy is 94.11%. This automated form filling not only reduced the delay in hospital admission, but also helped in treatment, because of the auto-filled medical history.

8. Enhanced Local Texture Feature Sets for Face Recognition Under Difficult Lighting Conditions

Author: TAN, X., & TRIGGS

Making recognition more reliable under uncontrolled lighting conditions is one of the most important challenges for practical face recognition systems. We tackle this by combining the strengths of robust illumination normalization, local texture-based face representations, distance transform-based matching, kernel-based feature extraction and multiple feature fusion. Specifically, we make three main contributions: 1) we present a simple and efficient preprocessing chain that eliminates most of the effects of changing illumination while still preserving the essential appearance details that are needed for recognition; 2) we introduce local ternary patterns (LTP), a generalization of the local binary pattern (LBP) local texture descriptor that is more discriminate and less sensitive to noise in uniform regions, and we show that replacing comparisons based on local spatial histograms with a distance transform based similarity metric further improves the performance of LBP/LTP based face recognition; and 3) we further improve robustness by adding Kernel principal component analysis (PCA) feature extraction and incorporating rich local appearance cues from two complementary sources-Gabor wavelets and LBP-showing that the combination is considerably more accurate than either feature set alone.

Chapter 3

REQUIREMENTS

3.1 Software Requirement Specification

A Software Requirements Specification (SRS) -a requirements specification for a software system – is a complete description of the behavior of a system to be developed. In addition to a description of the software functions, the SRS also contains non-functional requirements. Software requirements are a sub-field of software engineering that deals with the elicitation, analysis, specification, and validation of requirements for software.

3.2 Requirements:

3.2.1 Hardware Requirements

- System : Pentium IV 2.4 GHz or more
- Hard Disk: 40 GB.
- Monitor : 15 VGA Color.
- Mouse : Dell.
- Ram : 512 Mb

3.2.2 Software Requirements

- OpenCV
- MongoDB
- Python Language
- Visual Studio

3.3 Libraries and Packages

3.3.1 OpenCV

NumPy OpenCV (Open-Source Computer Vision Library) is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 18 million. The library is used extensively in companies, research groups and by governmental bodies.

It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. A full-featured CUDA and OpenCL interfaces are being actively developed right now. There are over 500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has a templated interface that works seamlessly with STL containers. Figure 3.1 OpenCV Logo

Figure 3.1 OpenCV Logo

3.3.2 MongoDB

MongoDB is the leading modern, general purpose database platform empowering innovators to create, transform, and disrupt industries by unleashing the power of software and data. Headquartered in New York, MongoDB has more than 35,200 customers in over 100 countries. The MongoDB database platform has been downloaded over 265 million times and there have been more than 1.5 million registrations for MongoDB University courses.

MongoDB was founded in 2007 by Dwight Merriman, Eliot Horowitz and Kevin Ryan – the team behind Double Click.

At the Internet advertising company DoubleClick (now owned by Google), the team developed and used many custom data stores to work around the shortcomings of existing databases. The business served 400,000 ads per second, but often struggled with both scalability and agility. Frustrated, the team was inspired to create a database that tackled the challenges it faced at DoubleClick.

This was when MongoDB was born. Figure 3.2 MongoDB Logo

Figure 3.2 MongoDB Logo

3.3.3 Tkinter

The tkinter package (“Tk interface”) is the standard Python interface to the Tcl/Tk GUI toolkit. Both Tk and tkinter are available on most Unix platforms, including macOS, as well as on Windows systems.

Running python -m tkinter from the command line should open a window demonstrating a simple Tkinter face, letting you know that tkinter is properly installed on your system, and also showing what version of Tcl/Tk is installed, so you can read the Tcl/Tk documentation specific to that version.

Tkinter supports a range of Tcl/Tk versions, built either with or without thread support. The official Python binary release bundles Tcl/Tk 8.6 threaded. See the source code for the _tkinter module for more information about supported versions.

Tkinter is not a thin wrapper, but adds a fair amount of its own logic to make the experience more pythonic. This documentation will concentrate on these additions and changes, and refer to the official Tcl/Tk documentation for details that are unchanged. Figure 3.3 is Tkinter Logo

Figure 3.3 Tkinter Logo

3.3.4 Python

Python is a programming language that lets you work more quickly and integrate your systems more effectively.

Python can be easy to pick up whether you're a first-time programmer or you're experienced with other languages. The following pages are a useful first step to get on your way writing programs with Python!

The community hosts conferences and meetups, collaborates on code, and much more. Python's documentation will help you along the way, and the mailing lists will keep you in touch.

The Python Package Index (PyPI) hosts thousands of third-party modules for Python. Both Python's standard library and the community-contributed modules allow for endless possibilities. Python is developed under an OSI-approved open-source license, making it freely usable and distributable, even for commercial use. Python's license is administered by the Python Software Foundation. Figure 3.4 Python Logo

Figure 3.4 Python Logo

3.3.5 Face Recognition

Face recognition is a method of identifying or verifying the identity of an individual using their face. Face recognition systems can be used to identify people in photos, video, or in real-time. Law enforcement may also use mobile devices to identify people during police stops.

But face recognition data can be prone to error, which can implicate people for crimes they haven't committed. Facial recognition software is particularly bad at recognizing African Americans and other ethnic minorities, women, and young people, often misidentifying or failing to identify them, disparately impacting certain groups.

Additionally, face recognition has been used to target people engaging in protected speech. In the near future, face recognition technology will likely become more ubiquitous. It may be used to track individuals' movements out in the world like automated license plate readers track vehicles by plate numbers. Real-time face recognition is already being used in other countries and even at sporting events in the United States. Figure 3.5 shows the working of Face recognition

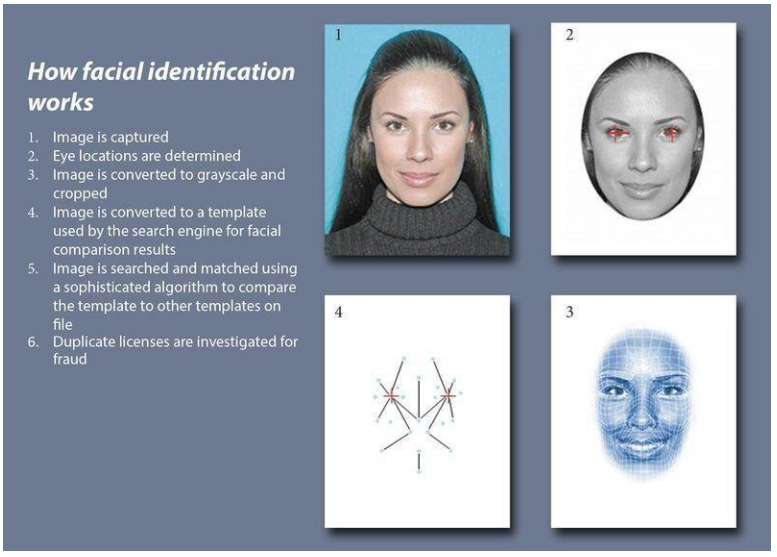

Figure 3.5 Face Recognition module

Chapter 4

PROJECT DETAILS

4.1 System Design

System design is the process of defining the architecture, components, modules, interfaces and data for a system to satisfy specified requirements. System design could see it as the application of systems theory to product development. Theory is some overlap with the disciplines of system analysis, systems architecture and systems engineering.

If the broader topic development "blends the perspective of marketing, design, and manufacturing into a single approach to product development," then design the act of talking the marketing information and creating the design of the product to be manufactured. Systems design is therefore the process of defining and developing systems to satisfy specified requirements of the user.

Until the 1990s systems design had crucial and respected role in the data processing industry. In the 1990s standardization of hardware and software resulted in the ability to build modular systems. The increasing importance of software running on generic platforms has enhanced the discipline of software engineering.

Object-oriented analysis and design methods are becoming the most widely used methods for computer systems design. The UML has become the standard language in object-oriented analysis and design. It is widely used for modelling software systems and is increasingly used for high designing non- software systems and organizations.

System design is one of the most important phases of software development process. The purpose of the design is to plan the solution of a problem specified by the requirement documentation. In other words, the first step in solution is the design of the project.

The design of the system is perhaps the most critical factor affecting the quality of the software. The objective of the design phase is to produce overall design of the software. It aims to figure out the modules that should be in the system to fulfil all the system requirements in efficient manner.

The design will contain the specification of all the modules, their interaction with other modules and the desired output from each module.

4.2 Data flow diagram

A data flow diagram (DFD) is a graphical representation of the flow of the visualization of data processing. On a DFD, data items flow from an external data source or internal data source to internal data source or external data sink via an internal process. DFD provides no information about the timing of process or about whether process will operate in sequence or in parallel.

The diagram below depicts the flow of data through the system. The flow of all modules stays constant, with the only variation being the final result. Inputs for the relevant modules, such as patient details and their emergency contact details, are obtained via a Tkinter GUI application.

Face data can be processed in 2 ways either capturing live face data by extracting only the facial part use face detection, else if there is any face data available in any dataset like Aadhaar database it can be used but these datasets should be a labeled data. These data set are then trained by passing them to an LBPH algorithm. Then those data are stored for future requirement in a database, these data are then retrieved during the testing phase if the patient is identified. Figure 4.1 is Dataflow Diagram of the proposed System

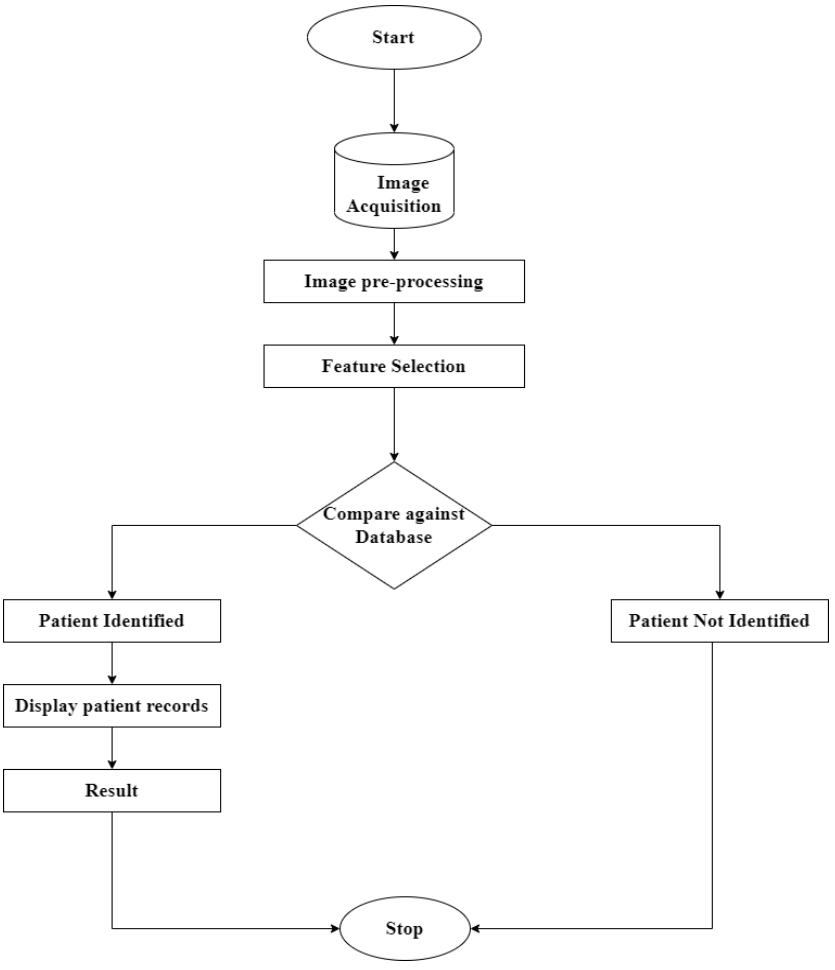

Figure 4.1 Dataflow Diagram of the proposed System

Chapter 5

SYSTEM IMPLEMENTATION

Implementation is the realization of an application, or execution of a plan, idea, model, design, specification, standard, algorithm, or policy. In other words, an implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through programming and deployment. Many implementations may exist for a given specification or standard.

Implementation is one of the most important phases of the Software Development Life Cycle (SDLC). It encompasses all the processes involved in getting new software or hardware operating properly in its environment, including installation, configuration, and running, testing, and making necessary changes. Specifically, it involves coding the system using a particular programming language and transferring the design into an actual working system. This phase of the system is conducted with the idea that whatever is designed should be implemented; keeping in mind that it fulfils user requirements, objective and scope of the system. The implementation phase produces the solution to the user problem. The Figure 5.1 below shows the process flow of our proposed system.

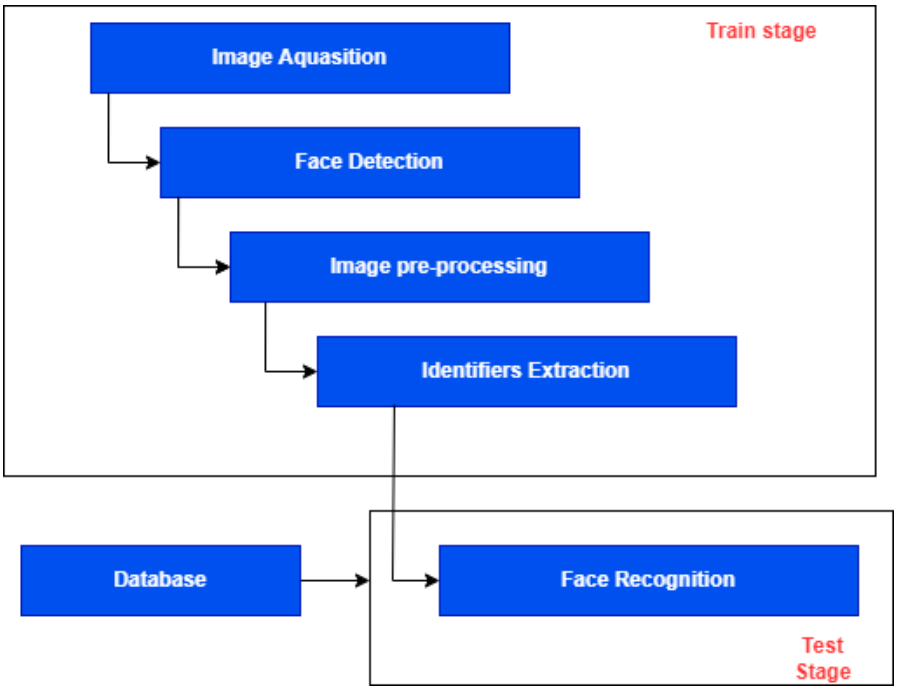

Figure 5.1. Process Flow Chart

5.1 Pseudo code

Pseudo code is an informal high-level description of the operating principle of a computer program or other algorithm. It uses the structural conventions of a programming language, but is intended for human reading rather than machine reading. Pseudo code typically omits details that are not essential for human understanding of the algorithm, such as variable declarations, system-specific code and some subroutines. The programming language is augmented with natural language description details, were convenient, or with compact mathematical notations. The purpose of using pseudocode is that is easier for people to understand than conventional programming language code, and that it is an efficient and environment independent description of the key principles of an algorithm.

It is commonly used in textbooks and scientific publications that are documenting various algorithms, and also in planning of computer program development, for sketching out the structure of the program before the actual coding takes place. No standard for pseudo code syntax exists, as a program in pseudo code is not an executable program. Pseudo code resembles, but should not be confused with skeleton programs, including dummy code, which can be compiled without errors. Flowcharts and Unified Modelling Language (UML) charts can be thought of as a graphical alternative to pseudocode, but are more spacious on paper.

The Project is divided into 3 different modules:

- Face Detection and collecting patient dataset
- Face recognition and Displaying patient details
- Sending emergency mail.

5.2 Data Pre-Processing and Gathering of Encodings

- Extraction of only the face from an image or video using face detection.
- Then these images are cropped and resized using OpenCV tools
- These images are stored for recognition phase during these stages' images are the converted to greyscale images.

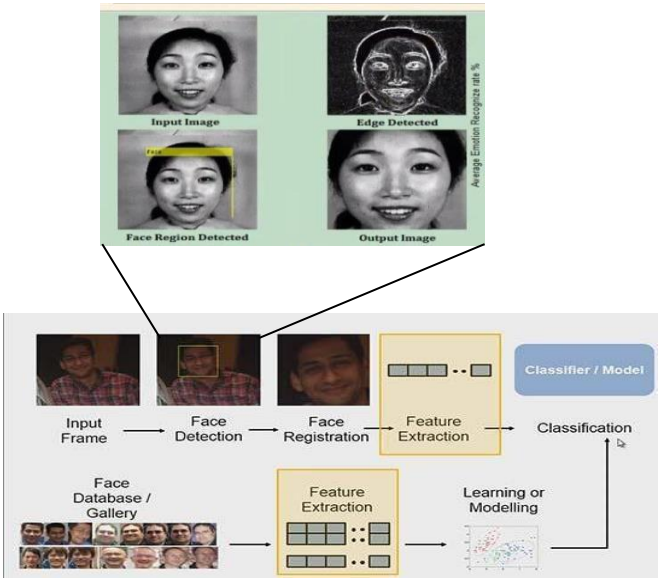

Figure 5.2. Data Processing

5.3 Compare Encodings of The Test Images and Train Images

As this process takes place during test phase, we compare the encodings of the train and test images since no images of the same person have the exact encoding but same persons images have very close encoding so we find out the which images among the labeled training images are a closest using Euclidean distance. Then using those results we identify a patient using face recognition. Figure 5.3 shows how encodings will generated using image.

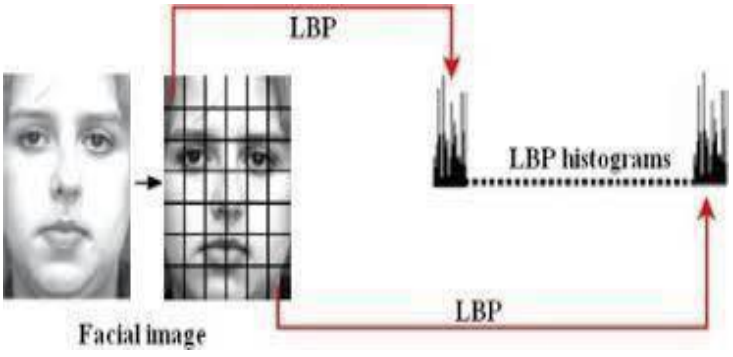

Figure 5.3. Encodings formation

Chapter-6

METHODOLOGY

6.1 Facial Detection

For Face Detection using Haar feature-based cascade classifiers, it is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Figure 6.1 shows process of Facial detection

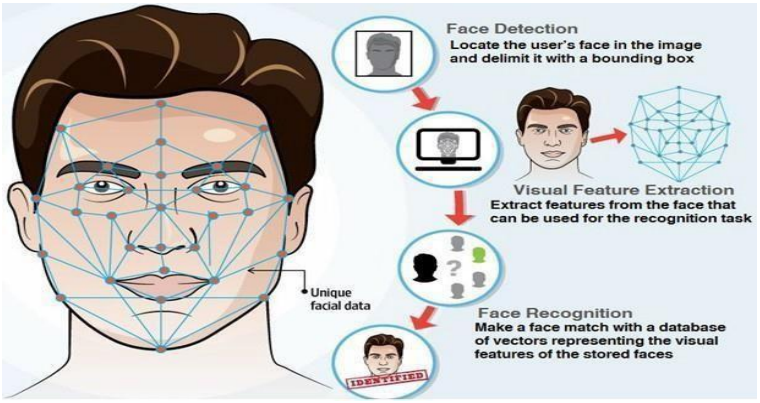

Figure 6.1. Process of Facial Detection

6.2 Extracting features using HAAR Cascade Algorithm

The next step corresponds to the Tracking of the face (tracking) and the normalization of the facial region. The Haar-Like feature algorithm is used to find the location of the human faces in frame or image that correspond to rectangles. After that we extract the features from the image, with the help of edge detection, line detection, and center detection. Then provide the coordinate of x, y, w, h, which makes a rectangle box in the picture to show the location of the face. It can make a rectangle box in the desired area where it detects the face. Figure 6.2 shows Tracking, Normalizing and Facial Recognition

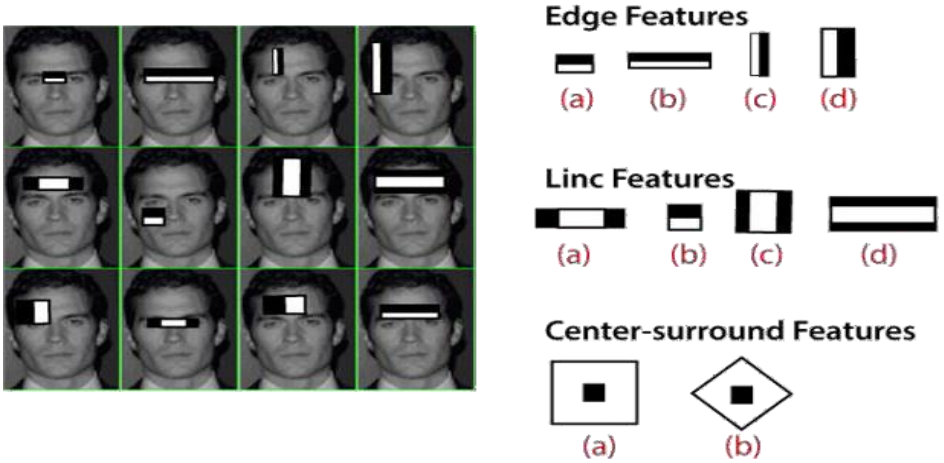

Figure 6.2. Tracking, Normalizing and Facial Recognition

6.3 Extraction Of Characteristics Through LBPH

First of all, we will comment on what the LBP operator consists of, and second, we will comment on how said operator has been applied to the extraction of the facial characteristics, both for facial identification and for the detection of spoofing. 1) LBP operator and improvements incorporated to said operator The Local Binary Pattern operator (LBP) [15] is a type of operator that is usually used for classification issues. It is a very powerful operator in everything related to the theme of classification of textures. The LBP operator has been applied to the extraction of the facial characteristics, both for facial identification and for the detection of patient. LBP is used to extract local features in the face and match it which most similar face in the database. This method works by dividing the face image into several blocks and in the matrix, we compare the pixels with center pixels. At the end we will get a binary number which we will be converted into decimal format as shown in Figure 6.3, which will be combined together under one vector which will help to recognize face.

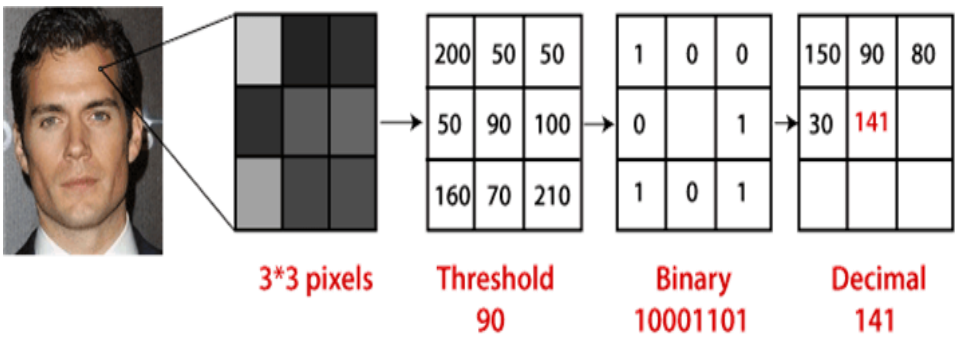

Figure 6.3 Extraction of characteristic through LBP

6.4 Extracting the Histograms from the Image for Face Recognition

The image is generated in the last step, we can use the Grid X and Grid Y parameters to divide the image into multiple grids, let's consider the following image:

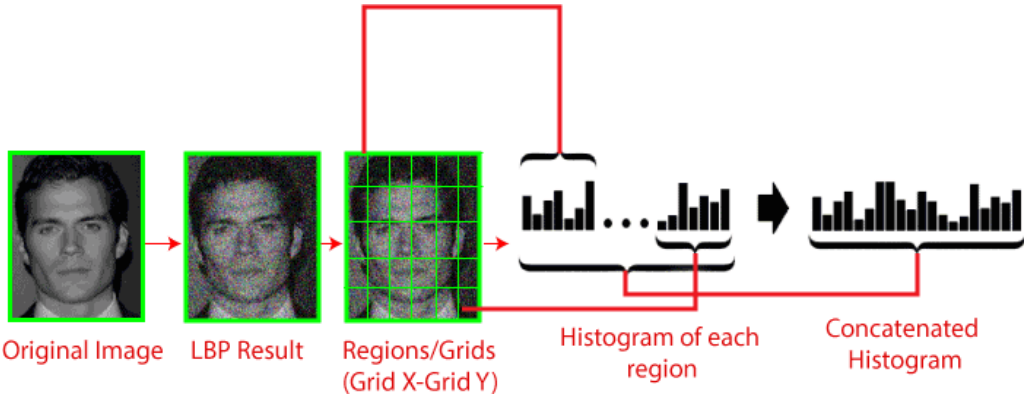

Figure 6.4. Extracting Histogram from images

We have an image in grayscale; each histogram (from each grid) will contain only 256 positions representing the occurrence of each pixel intensity. It is required to create a new bigger histogram by concatenating each histogram. As shown in the above Figure 6.4.

Now, the algorithm is well trained. The extracted histogram is used to represent each image from the training dataset. For the new image, we perform steps again and create a new histogram. To find the image that matches the given image, we just need to match two histograms and return the image with the closest histogram.

There are various approaches to compare the histograms (calculate the distance between two histograms), for example: Euclidean distance, chi-square, absolute value, etc. We can use the Euclidean distance based on the following formula:

$$D = \sqrt{\sum_{i=1}^{n}(\text{hist}\,1_i - \text{hist}2_i)^2}$$

The algorithm will return ID as an output from the image with the closest histogram. The algorithm should also return the calculated distance that can be called confidence measurement. If the confidence is lower than the threshold value, that means the algorithm has successfully recognized the face.

6.5 Performing Face Recognition

The calculated distance is stored in the database with the unique variable or with the patient names. we identify the patient face we compare the distance found while face recognition and the distance stored in the database, if they both are same then our face recognition is successful and we will have the access patient previous medical records and emergency details.

In order to achieve an efficient, robust and computationally light algorithm, we investigated what different descriptors and operators could be applied to efficiently represent the facial region. After conducting a thorough investigation, analyzing the state of the art and doing some preliminary tests, it was concluded that the LBP operator produces excellent results both in facial recognition. In addition, it is a computationally light operator.

Chapter 7

OBSERVATIONS AND RESULTS

The project uses frontend library Tkinter to ease out the access to the users. The figure below shows the landing page of the project. The project is named as Patient Identification using Facial Recognition.

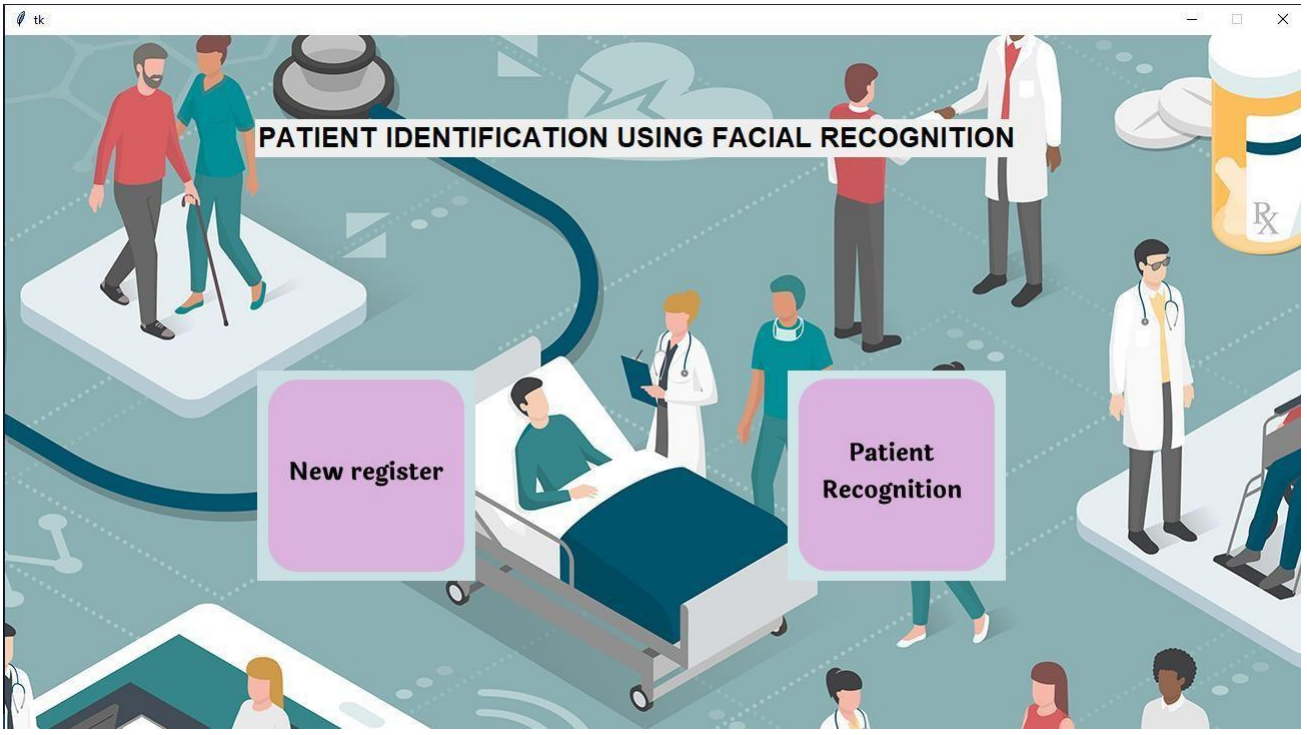

Figure 7.1. Landing Page of the Project

The landing page has many navigation points from which the user can easily navigate to different modules without the break of flow. As shown in the Figure 7.1 we have two option first option is New Register which is designed to gather the new patient details and store it in database. Second option is Patient Recognition which is designed to recognize the patient during the testing phase.

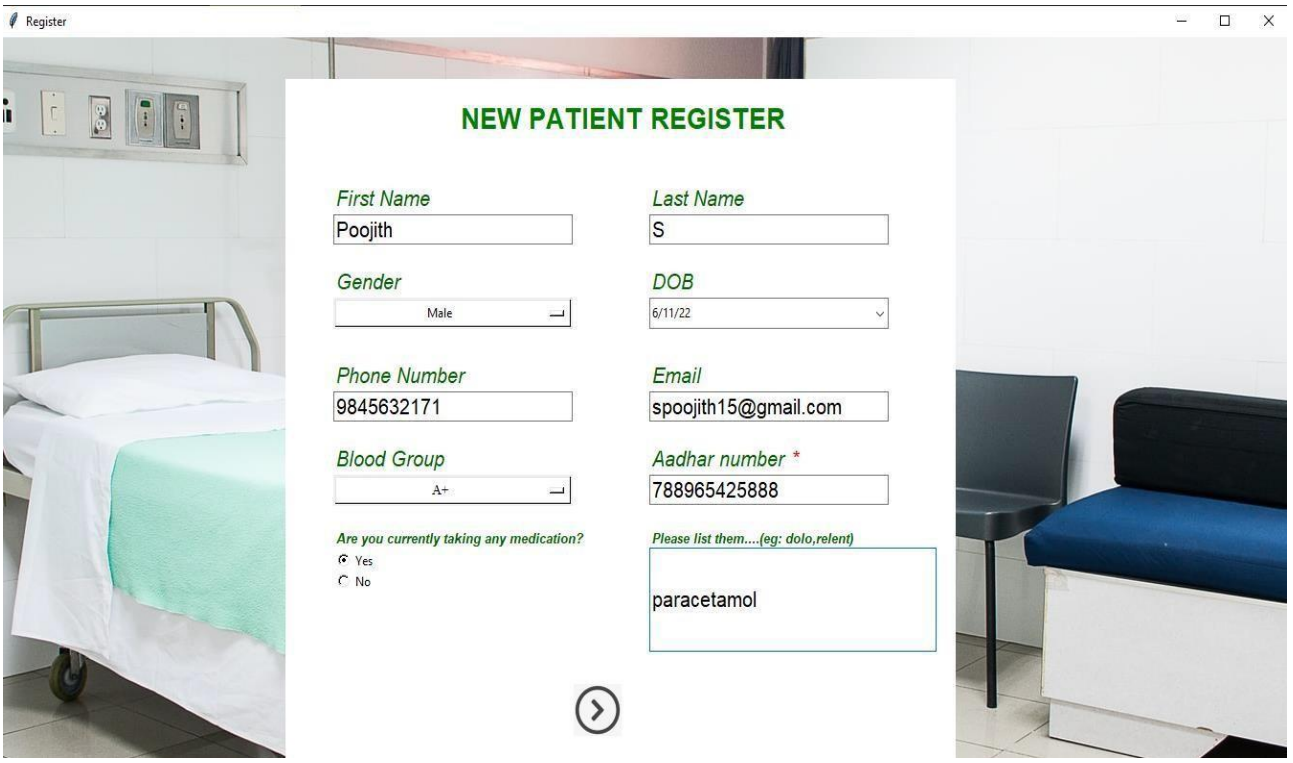

Figure 7.2. Patient Information Page

As shown in the Figure 7.2, Patient can enter his or her general information such as First Name, Last Name, Blood group, DOB, Aadhar number etc.

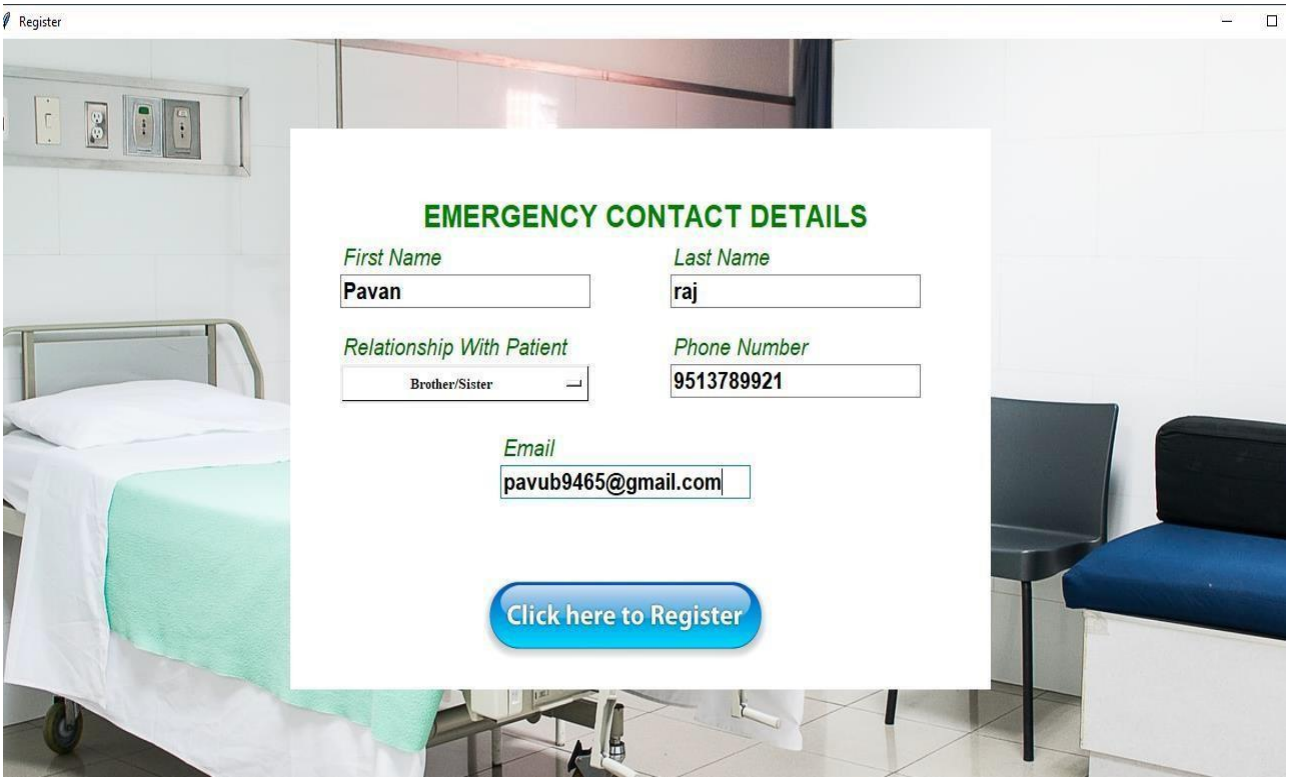

Figure 7.3. Emergency Contact Information

Above Figure 7.3. shows the Emergency contact details page. In this page we enter the emergency contact person details of patient.

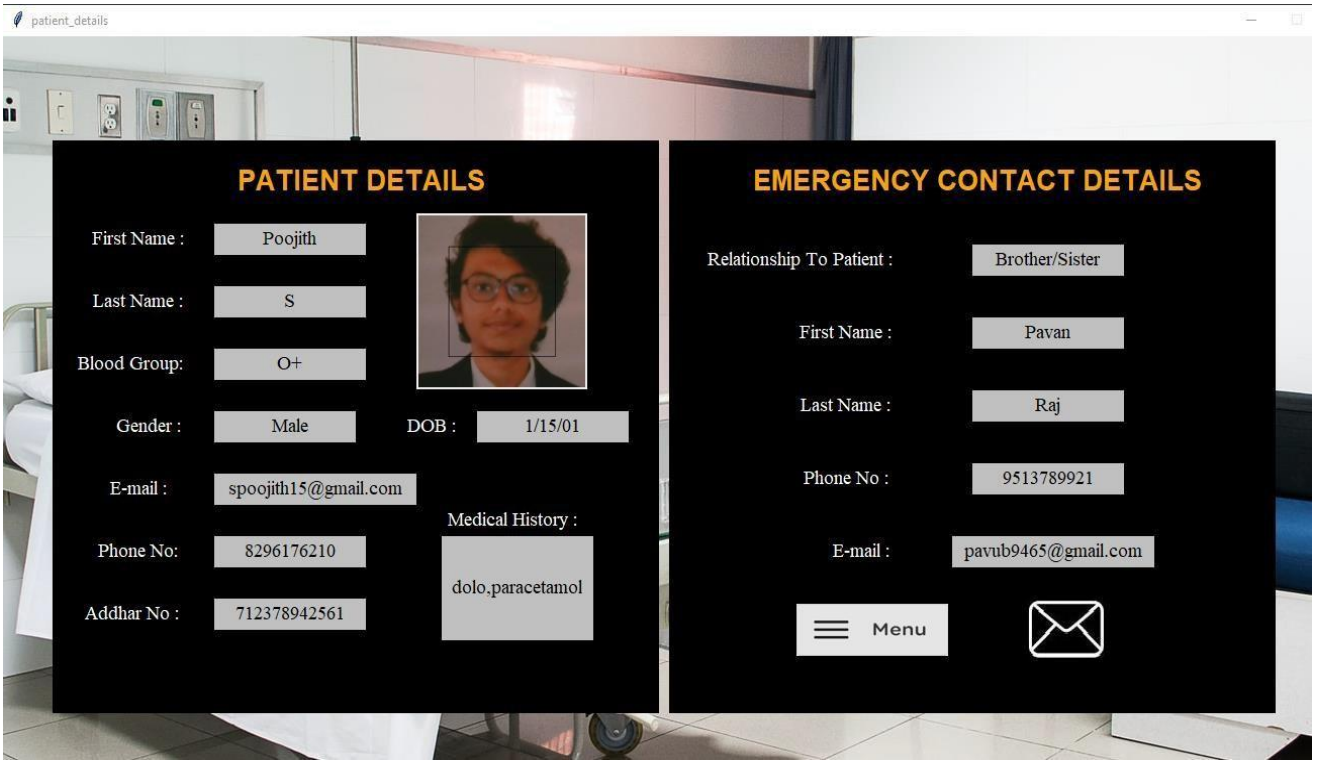

Figure 7.4. Patient Information Display After Face Recognition

If found encodings and encoding in database gets matched then the face recognition is successful. Then the above Figure 7.4 will be displayed which contains patient information and their emergency details and admin can send mail to patient emergency contact in case of emergency.

Chapter 8

CONCLUSION

We proposed a model in this paper that uses computer vision to digitize the traditional method of on-paper medical records, our main focus is to gather all the registered patient details and store it in a digital library/database so that we retrieve the medical records fast and easy at the time of emergency. The pipeline is built on an optimized combination of the Haar cascade and LBPH algorithms, which have been shown to be accurate and fast in inference while operating on medium-end systems. Following the COVID-19 pandemic, this model could be a great help in ensuring minimal contact in hospitals. The performance of this model has been more accurate in facial recognition compared to other similar works done in the past. The goal of this project is to use as few resources as possible to identify the patients at the time of emergency while maintaining accuracy rate of true positive result.

In conclusion, our model can be used as an alternative to identify the unresponsive patients who cannot be Identified with the any document and gather his/her medicals details/records if registered. With the advent of new upcoming technologies, there is always room for improvement and more value-added services few mentioned below.

Our model Identification based on facial recognition using LBPH algorithm is a protype and is in initially phase, so our model is only limited only for the local environment or single organization as for the future enhancement you can create a centralized patient database and access it across multiple organization using various cloud-based database. Instead of storing the images of patient, we could train those images and gather their encoding during the training phase and store the encoding in an encrypted format and use them in testing phase for comparison, unlike our model where we train the images and load the encoding at the testing phase which is comparatively slower. By doing so you could save the processing time during the recognition phase

Chapter 9

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