GOA COLLEGE OF ENGINEERING
FARMAGUDI, GOA

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

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HUMAN IDENTIFICATION USING GAIT RECOGNITION

by

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A project submitted
in partial fulfilment of the requirements
for the degree of
Bachelor of Engineering
in
Electronics and Telecommunication Engineering
GOA UNIVERSITY

under the guidance of

Prof. MILIND FERNANDES
Assistant Professor,
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CERTIFICATE

This is to certify that the project entitled

"HUMAN IDENTIFICATION USING GAIT RECOGNITION"

submitted by

Azfar Khoja	**P.R. No.: 201305838**
John George	**P.R. No.: 201305821**
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has been successfully completed in the academic year 2016-2017 as a partial fulfilment of the requirement for the degree of BACHELOR OF ENGINEERING in Electronics and Telecommunication Department, at Goa College of Engineering, Farmagudi.

(Internal Examiner) (External Examiner)

Place: Farmagudi, Ponda, Goa
Date:

PROJECT APPROVAL SHEET

The project entitled

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completed in the year 2016-2017 is approved as a partial fulfilment of the requirements for the degree of **BACHELOR OF ENGINEERING in Electronics and Telecommunication Engineering** and is a record of bonafide work carried out successfully under our guidance.

(Project Guide)
Milind Fernandes
Assistant Professor,
ETC Dept.

(Head of Department)
Dr. H. G. Virani
Professor, ETC Dept.

(Principal)
Dr. V. N. Shet
Goa College of Engineering

Place: Farmagudi, Ponda, Goa
Date:

Dedication sheet

This thesis is dedicated to our parents, teachers, friends and other acquaintances, who have been there for us in the thick and thin of the implementation of this project.

Acknowledgement

Apart from the combined effort of us four, this project wouldnt have been possible without the guidance and support of our Project Guide Prof. Milind Fernandes. We are grateful to you Sir.

We take this opportunity to thank Mr Valindo Godinho, CTO of Wafer O, a start-up currently situated in Panaji.He helped us with the initial design and working of our Windows App TRACE. He always made himself available to solve any queries and bugs in the code that we encountered.

We would also like to express our sincere gratitude to Dr.H.G.Virani, The Head of Department and the entire staff of Electronics and Telecommunication Department for providing all the required help and facilities needed for the completion of the project. One of the Senior Faculty Members always stayed back late to lock up the Department when we needed to work afterhours and we are really grateful for that.

Lastly, we would like to thank all our classmates who voluntarily helped us build the gait database

Contents

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Abstract

In recent years, biometric recognition and authentication has attracted a significant attention due to its potential applicability in social security, surveillance systems, forensics, law enforcement, and access control. A biometric system can be defined as a pattern-recognition system that can recognize individuals based on the characteristics of their physiology or behaviour. One biometric technique for unintrusive identification is gait recognition which basically identifies people by the way they walk. In former work, gait recognition is mainly achieved with camera systems. In this study, we present an approach for gait recognition using Microsoft Kinect V2, a peripheral for the gaming console XBOX One, which provides us with marker less tracking of human motion in real time. We extract and evaluate a number of static and kinematic features and present the results of various classification algorithms for person identification.

Chapter 1

Introduction

Compared to other biometric features such as the iris and fingerprint. Gait has some inherent advantages 1) Perceivable at a distance, on-contact, non-invasive 2) Doesnt require user cooperation 3) Gives fairly accurate readings under low light conditions. Also disguising, hiding ones gait or imitating some other persons gait is practically impossible. As a result it has fascinated several security-sensitive environments such as classified research and nuclear labs, military, banks etc. Gait recognition is particularly useful in crime scenes where other biometric traits (such as face or fingerprint) might be obscured intentionally.

Two common categories of gait recognition are appearance-based and model-based approaches. Among the two, the appearance-based approaches suffer from changes in the appearance owing to the change of the viewing or walking directions. Model based ones are view and scale invariant and reflect in the kinematic characteristics of walking manner. In this study we present a model based approach using the Microsoft Kinect sensor which offers us a 3D model of the human skeleton with capability to track up to 25 joints of the human body.

1.1 Motivation

The initial motivation to build a gait recognition system developed after watching the Gait Analysis scene in the movie Mission Impossible Rogue Nation (2015) where it was used for authentication for security purposes. Although at that time it felt as a futuristic technology, through research we realised that existing gait recognition approaches mostly use standard video cameras for capturing and recording the movement of walking persons. Here, the main difficulty lies in the extraction of characteristic features that can be used for identification. The challenges of existing gait recognition system and the possibilities Kinect offers lead to the assumption that the problem of gait recognition could be simplified using the Kinect sensor.

1.2 Proposed Idea

In this paper we propose a skeleton model based approach (provided by Microsoft Kinect Sensor) for gait recognition and person identification. Our system consists of three components: The first component records the skeletal data offered by Kinect using the SDK provided by Microsoft. The second component processes on this data using MATLAB for feature extraction. Finally we use different classification algorithms available in MATLAB classification toolbox to identify a person using previously recorded training data and compare their performance and accuracy. This is a prototypic implementation of a gait recognition system, where we evaluate the possibilities of gait recognition using the Microsoft Kinect.

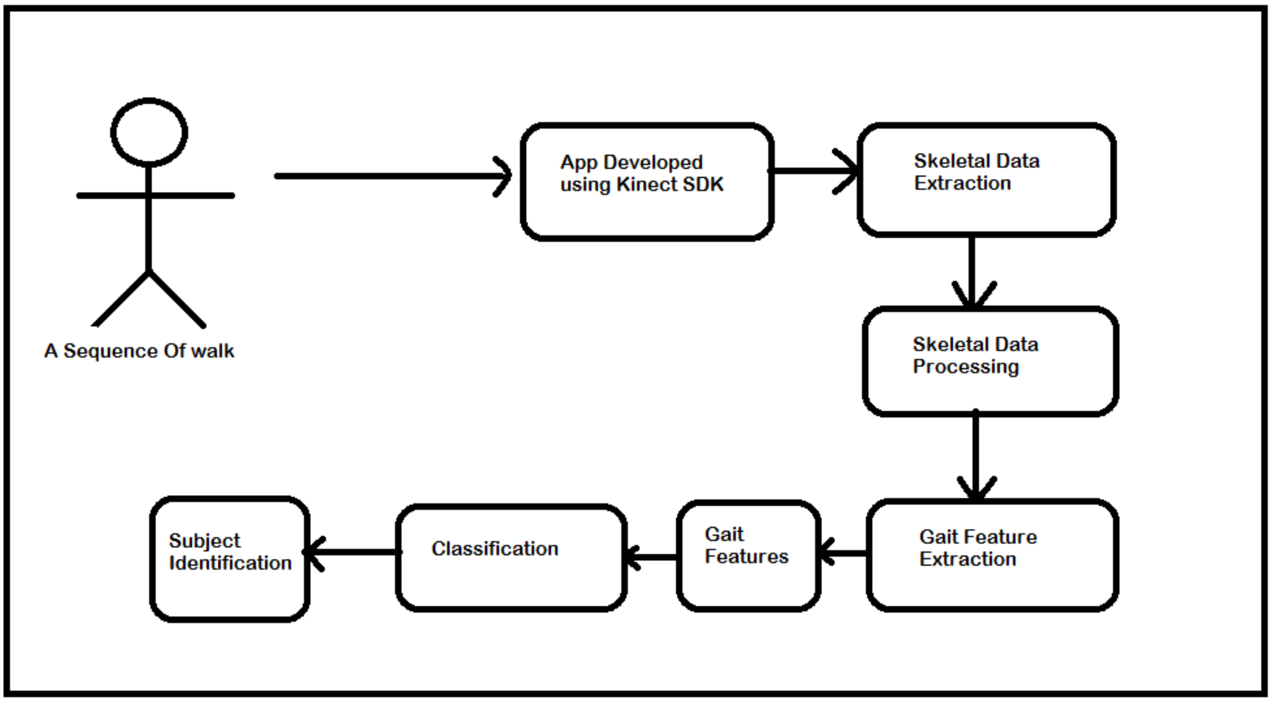

Figure 1.1: Process flow Diagram

Chapter 2

Literature Review

2.1 Full Body Gait Analysis with Kinect

1. Authors: Moshe Gabel, Ran Gilad-Bachrach, Erin Renshaw and Assaf Schuster

2. Abstract: Human gait is an important indicator of health, with applications ranging from diagnosis, monitoring, and rehabilitation. In practice, the use of gait analysis has been limited. Existing gait analysis systems are either expensive, intrusive, or require well-controlled environments such as a clinic or a laboratory. We present an accurate gait analysis system that is economical and non-intrusive. Our system is based on the Kinect sensor and thus can extract comprehensive gait information from all parts of the body. Beyond standard stride information, we also measure arm kinematics, demonstrating the wide range of parameters that can be extracted. We further improve over existing work by using information from the entire body to more accurately measure stride intervals. Our system requires no markers or battery-powered sensors, and instead relies on a single, inexpensive commodity 3D sensor

with a large preexisting install base. We suggest that the proposed technique can be used for continuous gait tracking at home.

3. Hardware used : Microsofts Kinect Xbox 360 console.

4. Methodology : Our technique uses a virtual skeleton produced by the Kinect sensor and software. The skeleton information is converted into a large set of features which are fed to a model that predicts the values of interest. For example, inorder to measure stride duration, the model detects whether the foot is touching the ground. The outcome of this model is fed to a state machine that detects the current state from which the measurements are derived.

5. Conclusion In this work we have presented a novel method for full body gait analysis using the Kinect sensor. Using the virtual skeleton as the input to a learned model, we demonstrated accurate and robust measurements of a rich set of gait features. We showed that our method improves on prior art both in terms of having smaller bias and in having smaller variance. Moreover, our method can be extended to measuring other properties, including lower limb angular velocities and core posture. The sensor used is affordable and small, thus allowing installation in domestic environments. Since the sensor does not require maintenance, it allows for continuous and long term tracking of gait and its trends. These properties enable many applications for diagnosis, monitoring and adjustments of treatment. However measuring the utility of the methods presented here for medical applications is a subject for further research.

2.2 Motion Analysis using Kinect sensor

1. Authors: Richa DCosta, Manpreet Kaur, Nishtha D. Wanchoo. Under the guidance of PROF. MILIND FERNANDES, Asst. Professor at Goa College of Engineering

2. Abstract: With the advent of Microsoft Kinect sensor, a flexible low cost tool has been made available that enables marker less tracking of human motion in real time. The study explores the possibility of utilizing Microsofts Kinect sensor to analyse the biomechanics of the shot put throw. It presents a software prototype capable of capturing, recording, analyzing and comparing movement patterns using three-dimensional vector angles. The goal of the present work is to ease the analysis of a shot put game for overcoming the difficulty of visual error detection in shotput game using a software prototype which compares an amateurs game to that of a professional to yield results, which is implemented by using the Kinect sensor. It combines both the biomechanics analysis and Kinect motion capturing and develops a shot put game improvement solution with coaching evaluation.

3. Tools used : Microsoft Kinectv2 sensor, Visual studio 2013, Excel 2013

4. Methodology : Shotput is a game involving many complex motions simultaneously which includes rotational, translational and lateral motions. For any beginner, it gets very difficult to detect the stage of the throw which needs an improvement. Existing methods involve a coach trying to evaluate the stage of flaw in the game by observation. This has 2 major drawbacks: 1)The presence of a skilled trainer is inevitable for every throw of the beginners practice session. 2)The accuracy level would be lower than desired, since the correction of flaw in the game is manual method. To overcome the above difficulties ,we have developed a software prototype for which could detect the flaw in the beginners game without constant

physical presence for the busy trainer. Our prototype software takes care of mainly 3 important parameters in the game: 1. The time duration at each phase: It must be well within the range of our reference for maximum release velocity. 2. The following angles at the start of the initial phase: Right knee Left Knee Right hip Right elbow If these angles are well within our reference angles, it results in higher build up energy to have an increased release velocity 3. The release angle of the player: When release angle is within the range of 38-42, maximum range is attained.

5. Conclusion : The Kinect system being a marker-less system, is able to capture the human motion with a reduction in time, whereas in a marker-based system attaching markers on the skin of the subject is a time consuming process (which can take 15 to 20 minutes). Although our software prototype could be used in a shot put game to provide coaching evaluation, the results cannot be completely relied upon, as the accuracy was limited due to decreased resolution of Kinect sensor. A few drawbacks of this sensing technology were the fixed location of the sensor with a range of capture of only roughly ten meters, a difficulty in fine movement capture, and shoulder joint biomechanical accuracy. The better reliable results refer to the hip flexion and knee angles and the results of hip adduction and ankle angles are not accurate enough to be relied on. This suggests that Kinect is better for capturing the rotation pattern of the joints with a large range of motion. In conclusion, Kinect system is a reliable system which permits to obtain acceptable kinematics results.

Chapter 3

Design/Implementation(whichever applicable)

3.1 Problem Statement

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ment. Work done: Block diagram, design(software, hardware), Implementation

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Chapter 4

System Analysis

4.1 Observations

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4.2 Results

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4.3 Discussion

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Chapter 5

Conclusion

5.1 General Conclusion

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5.1.1 This is a sub section

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5.2 Challenges

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5.3 Future Work

This is the third section of the fifth chapter.

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Appendices

Appendix A

Appendix

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Appendix B

Data Sheets

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