Final Year Project Report

A resource framework for simulation, visualization, and analytics of large crowds

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Dedication

We would like to dedicate this effort to our **parents**, who have supported us throughout the course of our studies, and our teachers with direction of whom we have managed to come this far.

We would like to especially recognize the commendable mentoring of our project advisor **Dr. Adnan Shahzada**, who taught us to devise problem solving strategies in a critical manner and not to settle for less than the superlative.

We would also like to acknowledge **Dr. Adnan Abid** who came up with this idea and not only gave us the initial thrust in the realm of big data but also encouraged and steered us in hardest of times.

Acknowledgment

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A special thanks to **Mr. Maqsood Ahmad** for helping us with computing infrastructural issues specifically Linux configuration, virtualization, and networking related problems.

Lastly, a special gratitude for **stackoverflow. com** and its community of developers.

Final Approval

Panel of Examiners

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- **Program Director (Final Year Projects)** _____
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- **Co-Supervisor** _____
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Project Title: A Resource Framework for Simulation, Viusalization and Analytics of Large Crowds.

Objective: Provide crowd modeleres and authourities with a tool to effectively manage crowd in events of mass gathering.

Undertaken by : Monis Hafiz Abdul Ghaffar & Hafiz Taha Jamil

Supervised by: Dr. Adnan Shahzada& Dr. Adnan Abid

Starting Date: Mar 15, 2016

Completion Date: Apr 10, 2017

Tools Used: SIAFU (Context Simulator), MongoDB (NoSQL Storage), Spark(In-memory Cluster Computing Framework), Eclipse IDE

Operating System: Linux (Ubuntu), Windows 10

Documentation: Version 1.0

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Abstract

Crowd management inlarge events with hundreds of thousands of individuals are a critical challenge. Use of computer vision techniques on visual feed has been the typical approach throughout the years to monitor mobility and behaviors of crowds. despite the substantial advancement in this field, the massive deployment cost of a camera network and limitations of image processing restricts the productivity of this approach when applied at large scale. on the other hand, the evolving trend of smart or context aware environments has led to the proposition of geographically informative systems in which advance tracking technologies are used for collection of quantitative movement data. individuals within a crowd are observed as profiled users, thus, making it an identifiable crowd. gps localization [1] and proximity-based [2] tracking has been used to capture complex crowd dynamics during an event.

following the above line of thought,

ourapproachemphasizesonmanaginglargescaleeventsthroughmultilevelcontextualinformationandvisualizations.productiveinformationoncrowdconditionisattainedbyperformingrealtimeanalyticsonpositionaldata of individuals

crowd.thenectarfromrawdataisextractedbyharnessingthepowerofdistributedprocessingplatformstoprocesslargeamountsofdataparallelly. the generated data is filtered and modeled to ensure the consistency of data coming at high volume and velocity

The other aspect of the project is to simulate crowd dynamics before hand predict probable outcomes. for realistic simulation of such events, the approach of multi-agent system (mas) is considered suitable as the agents are expected to move to their goals, interact with their environment, and respond to each other. mas is also postulated as preferred approach for emergency evacuation simulations [3] because mas model problem in terms of autonomous interacting component-agents, which is proving to be a more natural way of simulating the unpredictability factor of large crowds.

a generic simulator [4] is used for basic modeling of entities in a scenario. the simulator itself is broad in terms of information sources but limited in terms of even-driven activities and behaviors. we have extended and quantified the concept toward immensely crowded events and activities of individuals it comprehends. We advocate as endless approach to model, simulate, analyze, and visualize crowd situations for actual venue settings. We equip crowd modelers and event organizers with a tool to effectively manage large events.

REVISION CHART

Version	Primary Author(s)	Description of Version	Date Completed
Draft	Hafiz Taha Jamil	Initial draft created for distribution and review comments	21-09-2016
Preliminary	Monis H. A. Ghaffar	Second draft incorporating initial review comments, distributed for final review	15-12-2016
Final	Hafiz Taha Jamil	First complete draft, which is placed under change control	26-04-2017

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1. INTRODUCTION

1.1 Motivation

Thousands have lost their invaluable lives due to human crush and stampedes in large events all around the world. These stampedes and crushes are primarily the resultant of crowd congestion and mass panic. Crowd management is emerging as a hot topic of research due to continuity of the problem. However, earlier work was focused on tackling the problem by means of computer vision techniques. But the deployment cost and overhead on image processing on one end with the evolving inclination towards context aware environments on the other has led to the proposition of advance tracking technologies. These are used for collection of positional data. GPS localization [1] and proximity-based [2] tracking has been used to capture complex crowd dynamics during an event. These large sets of collected data needs a distributed and parallel computing processing infrastructure to extract value out of that raw data in real time.