

BUSITEMA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING
BACHELOR OF COMPUTER ENGINEERING

FINAL YEAR PROJECT REPORT
AGRI - TOUR SEASONAL CHANGES MOBILE INFORMATION
SYSTEM

BY

MBABAZI ESTER

BU/UP/2013/198

E-mail: ester.mbabazi@gmail.com

Tel: [+256758804433](tel:+256758804433)/[+256776804433](tel:+256776804433)



Supervisor: Ms. Asingwire Barbara Kabwiga

**This Project report is submitted to the Faculty of Engineering in Partial
Fulfillment for the Award of a Bachelors of Computer Engineering Degree of
Busitema University**

May, 2017

ACKNOWLEDGEMENT

First and foremost, I extend my sincere and inexplicable gratitude to the Almighty God who enabled me to contrive through all the challenges up to this time. My beloved Jesus Christ, I love you more.

I would also like to acknowledge and appreciate all my supervisors; Ms. Asingwire Barbara Kabwiga and other lecturers for their whole-heartedly support/guidance especially toward this cause, the project work from project proposal time up to the accomplishment of the project.

To my classmates who sacrificed their time and knowledge and engaged in discussions as regards the successful development of my project; especially the outstanding Mr. Muwanguzi Paul, Mr. Twehamye Crispus among many others I say bravo!

I also extend my thanks to my brother Mr. Muhwezi Boaz and guardians who have always financed me in different endeavors as regards my Education.

Last but not least, I thank God for the Students' Guild that has nurtured me into an influential leader, with good public speaking skills, courage among others. I love Busitema University Students' Guild. A rapturous applause goes to all leaders I have worked with in the regime 2014/2015 and the regime of 2016/2017.



DEDICATION

To my beloved aunt Kyomuhendo Salima, your parental care for me has given me inspiration to become a purposeful person. To my dear parents, Mr. Banturaki Godfrey and Mrs. Banturaki Monica, you have always been there for me even when the going seems toughest, your tireless efforts to get tuition is never to be forgotten. My mentor Mr. Akatageka Eden, your advice made me cling on to God and to finish Campus when I am still a woman of virtue. I love you all and may the Almighty God reward you with unfathomable blessings, Glory is to God Almighty.

DECLARATION

I, **MBABAZI ESTER** do hereby declare that this Project Report is my original work and/or has not been submitted for any other degree award to any other University or institution of higher learning before.

Signature 

Date 31/05/2017

Name MBABAZI ESTER

Bachelor of Computer Engineering

Department of Computer Engineering

Busitema University.

APPROVAL

This project report has been submitted with the approval of the following supervisor.

Signature:



Ms. Asingwire Barbara Kabwiga
Department of Computer Engineering
Faculty of Engineering
Busitema University.

LIST OF FIGURES

Figure 4. 1 Conceptual diagram of System.....	27
Figure 4. 2 User case Diagram of the System.....	30
Figure 4. 3 logic data flow diagram	31
Figure 4. 4 Sample Weather Data for Busia	31
Figure 4. 5: Sample Weather Data for Tororo	32
Figure 4. 6 Sample Weather Data for Tororo from UNMA	32
Figure 5. 1 : Code for GPS Locations.....	36
Figure 5. 2 App - Showing results during testing on the 30/03/2017 at 11am.....	38
Figure 5. 3 App showing weather conditions and ten years forecast while user located in Busia On the 5/04/2017 at 9:30am.....	39
Appendix 1 App while user is in Busia on the 9/04/2017 at 9:00am	45
Appendix 2 App showing on Wednesday 5/04/2017 at 11:00am and on Wednesday 12/04/2017 at 11:00am respectively.	46
Appendix 3 App showing Tororo ten years weather forecast.....	47
Appendix 4 Screenshot of code for advice	48
Appendix 5 Java file code for forecasting	51
Appendix 6 Graph of weather parameters.	52
Appendix 7 Letter to collect data.....	53

LIST OF ACRONYMS

AAA	Authentication, Authorization and Accounting
ADT	Android Development Tool(s)
App	Application
API	Application Program Interface
GPS	Global Positioning System
GIEWS	Global Information and Early Warning System on Food and Agriculture
HEWS	Humanitarian Early Warning Service
IDE	Integrated Development Environment
IPCC	Intergovernmental Panel on Climate Change
PAN	Personal Area Network
WMO	World Meteorological Organization
SMS	Short Messaging Service
SMTP	Simple Mail Transfer Protocol
SQL	Structured Query Language
TCP/IP	Transfer Control Protocol/Internet Protocol
UNEP	United Nations Environment Programme
UNMA	Uganda National Meteorological Authority
UNWTO	United Nations World Tourism Organization
WFP	World Food Programme

TABLE OF CONTENTS

ACKNOWLEDGEMENT	i
DEDICATION	ii
DECLARATION	iii
APPROVAL	iv
LIST OF FIGURES	v
LIST OF ACRONYMS	vi
TABLE OF CONTENTS.....	vii
ABSTRACT.....	1
CHAPTER ONE: INTRODUCTION.....	2
1.1 Background.....	2
1.2 Problem Statement.....	4
1.3 Objectives	5
1.3.1 Main Objective.....	5
1.3.2 Specific Objective.....	5
1.4 Justification of the Project	5
1.5 Technical / Geographical Scope	5
CHAPTER TWO: LITERATURE REVIEW	7
2.0 Introduction.....	7
2.1 Causes of Seasonal Changes in Uganda	8
2.2 Impacts of Seasonal Changes on Agriculture in Uganda.....	8
2.3 Impacts of Seasonal Changes on Tourism in Uganda.....	9
2.3.1 Direct climatic impacts:	9
2.3.2 Indirect environmental change impacts:	10
2.4 The Role of the Media Regarding Seasonal Changes in Uganda	10
2.5 Related Systems.....	11
2.5.1 A Road Weather Information System (RWIS).....	11
2.5.2 International and national drought early warning systems:	11
2.5.3The Global Forecast System (GFS)	12

2.6 Technologies for Mobile Communication Systems	12
2.6.1 Wireless communication	12
2.6.2 Global positioning system (GPS).....	13
2.6.2 Web service Technology.....	13
2.6.3 Web service Standards	13
2.6.4 Web service Security	14
2.6.5 Multi Media Services (MMS).....	15
2.6.6 Short Message Services (SMS).....	15
2.7 Weather Forecasting in Uganda.....	15
2.7.1 Some of the weather conditions parameters.....	16
2.7.2 Methods of Weather Forecasting	16
2.8 Some of the governmental organs of Uganda concerned with Climate, Agriculture and Tourism ..	18
2.8.1 Uganda National Meteorological Authority (UNMA).....	18
2.8.3 Ministry of tourism, wildlife and heritage and the Uganda tourism board	19
2.8.4 Ministry of agriculture animal industry and fisheries	20
2.9 Proposed system.....	20
2.9.1 Overview of the System	20
2.9.2 Strengths of the System.....	20
CHAPTER THREE: METHODOLOGY	22
3.0 Introduction.....	22
3.1 Requirements Gathering	22
3.1.1 Literature Review.....	22
3.1.2 Consultations.....	22
3.2 Requirements Analysis	23
3.2.1 Data Analysis.....	23
3.2.2 Functional analysis.....	23
3.2.3 Functional requirements.....	24
3.2.4 Non-functional requirements.....	24
3.3 System Design	25
3.4 Tools Used To Implement the System.....	25
3.5 Testing, Validation and Implementation.....	25
3.5.1 Testing.....	25

3.5.2 Validation	26
3.5.3 Implementation	26
CHAPTER FOUR: SYSTEM DESIGN AND ANALYSIS	27
4.0 Introduction	27
4.1 System Design	27
4.2 User case Diagram	29
4.3 Logic Diagram	30
4.4 Sample Weather Data from Tororo Weather Station	31
4.4.2 Data for Tororo	32
4.4.3 Sample Weather Data from Uganda National Meteorological Center, Data for Rainfall and Temperature	32
CHAPTER 5: IMPLEMENTATION AND TESTING	33
5.0 Introduction	33
5.1 Development platforms	33
5.2 CODE DESIGNS	34
5.2.1 Sample Database code designs in MySQL	34
5.2 System Operation	37
5.3 Verification	37
5.4 System Testing	37
5.5 System Validation	38
CHAPTER SIX: DISCUSSIONS AND RECOMMENDATIONS	40
6.0 Introduction	40
6.1 Summary of the work	40
6.2 Critical analysis / appraisal of the app	40
6.3 Proposals / Recommendations for future work	41
6.5 Conclusion	41
REFERENCES	42
APPENDICES	45

ABSTRACT

In Uganda, about 71% of the citizens rely on subsistence farming, which is heavily dependent on rain seasons. Climate change and variability with seasonality influences farmers' decisions about when to sow and harvest.

Among the economic activities carried out in Uganda, tourism is also greatly affected by inconsistent seasonal changes. Tourism in Uganda is focused on Uganda's landscape and wildlife. It is a major driver of employment, investment and foreign exchange. Climate is an essential resource for tourism, and especially for the beach, nature and winter sport tourism segments. Changing climate and weather patterns at tourist destinations and tourist generating countries can significantly affect the tourists' comfort and their travel decisions.

To prevent all this, a system that focuses on weather prediction, sharing information on weather / seasonal changes, identifying possible threats of disaster and advice users accordingly was developed.

The Agri-Tour seasonal changes mobile information system for mobile phones forecasts weather in real time basing on the location of the user after measuring the weather parameters that is to say; temperature, rainfall/precipitation, wind, solar radiation, relative humidity. Inform the users and advise them accordingly.

CHAPTER ONE: INTRODUCTION

1.1 Background

Agricultural production is a key element of food security in many agricultural countries in Africa. In Uganda, about 71% of the citizens rely on subsistence farming, which is heavily dependent on rain seasons [1]. Climate change and variability is likely to adversely affect these African countries including Uganda, particularly as they affect the ability of smallholder farmers to raise enough food to feed themselves. Seasonality influences farmers' decisions about when to sow and harvest, and ultimately the success or failure of their crops. Farmers stress out the significant changes in the timing of rainy seasons and the pattern of rains within seasons, including: more erratic rainfall coming at unexpected times in and out of season; extreme storms and unusually intense rainfall are punctuated by longer dry spells within the rainy season; increasing uncertainty as to the start of rainy seasons in many areas; short or transitional second rainy seasons are becoming stronger than normal or are disappearing altogether.[1]

These farmer perceptions of change are striking in that they are geographically widespread and are remarkably inconsistent across diverse regions [2]. The impact of these changes on farmers with small plots and few resources is large. Farming is becoming riskier because of heat stress, lack of water, pests and diseases that interact with ongoing pressures on natural resources. Besides agriculture, many other activities rely on weather information and as such it is paramount that weather information delivery is done accurately and timely. Among the actives, tourism is also greatly affected by inconsistent seasonal changes [3].

Tourism in Uganda is focused on Uganda's landscape and wildlife. It is a major driver of employment, investment and foreign exchange, contributing 4.9 trillion Ugandan shillings to Uganda's GDP in the financial year 2012-13 [4]. Climate is an essential resource for tourism, and especially for the beach, nature and winter sport tourism segments. Changing climate and weather patterns at tourist destinations and tourist generating countries can significantly affect the tourists' comfort and their travel decisions. Changing demand patterns and tourist flows will have impacts on tourism businesses and on host communities, as well as knock off effects on related sectors, such as agriculture, handicrafts or construction [5]. Uganda as a country has a national body that manages these changes in climate (UNMA), there are other

REFERENCES

- [1] A. Corner, "Communicating climate change in Uganda: Challenges and opportunities," *Hidden Heat*, 2011.
- [2] F. M. Mwaura and G. Okoboi, "Climate variability and crop production in Uganda," *Journal of Sustainable Development*, vol. 7, no. 2, p. 159, 2014.
- [3] H. Osbahr, P. Dorward, R. Stern, and S. Cooper, "Supporting agricultural innovation in Uganda to respond to climate risk: linking climate change and variability with farmer perceptions," *Experimental Agriculture*, vol. 47, no. 02, pp. 293-316, 2011.
- [4] R. Naidoo and W. L. Adamowicz, "Biodiversity and nature-based tourism at forest reserves in Uganda," *Environment and Development Economics*, vol. 10, no. 02, pp. 159-178, 2005.
- [5] Y. Moyini and B. Uwimbabazi, "Analysis of the economic significance of gorilla tourism in Uganda," *International Gorilla Conservation Programme*, 2000.
- [6] S. D. Campbell and F. X. Diebold, "Weather forecasting for weather derivatives," *Journal of the American Statistical Association*, vol. 100, no. 469, pp. 6-16, 2005.
- [7] A. H. Murphy, "What is a good forecast? An essay on the nature of goodness in weather forecasting," *Weather and forecasting*, vol. 8, no. 2, pp. 281-293, 1993.
- [8] N. Hepworth and M. Goulden, "Climate Change in Uganda: Understanding the implications and appraising the response," 2008.
- [9] T. Ojo, "Political economy of Huawei's market strategies in the Nigerian telecommunication market," *International Communication Gazette*, p. 1748048516689182, 2017.
- [10] P. Huxley and W. Van Eck, "Seasonal changes in growth and development of some woody perennials near Kampala, Uganda," *The Journal of Ecology*, pp. 579-592, 1974.
- [11] A. Charland and B. Leroux, "Mobile application development: web vs. native," *Communications of the ACM*, vol. 54, no. 5, pp. 49-53, 2011.
- [12] G. Tumushabe, T. Muhumuza, E. Natamba, N. Bird, B. Welham, and L. Jones, "Uganda national climate change finance analysis," *London and Kampala: Overseas Development Institute and the Advocates Coalition for Development and Environment*, 2013.

- [13] T. Wagner, "Seasonal changes in the canopy arthropod fauna in *Rinorea beniensis* in Budongo Forest, Uganda," in *Tropical Forest Canopies: Ecology and Management*: Springer, 2001, pp. 169-178.
- [14] M. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson, *Climate change 2007: impacts, adaptation and vulnerability*. Cambridge University Press Cambridge, 2007.
- [15] V. Guardian, "Road Weather Information Systems," *printed Oct*, vol. 30, p. 1, 2009.
- [16] M. Lipicnik, "ROAD-WEATHER INFORMATION SYSTEM," in *Ninth PIARC International Winter Road Congress, Technical Report, Volume 1*, 1994.
- [17] S. Mändzuka, V. Golenic, and N. Jelusic, "Road Weather Information System," in *17th ITS World Congress*, 2010.
- [18] R. S. Pulwarty and M. V. Sivakumar, "Information systems in a changing climate: Early warnings and drought risk management," *Weather and Climate Extremes*, vol. 3, pp. 14-21, 2014.
- [19] i. Kanamitsu et al., "Recent changes implemented into the global forecast system at NMC," *Weather and Forecasting*, vol. 6, no. 3, pp. 425-435, 1991.
- [20] G. J. Foschini, G. D. Golden, R. A. Valenzuela, and P. W. Wolniansky, "Simplified processing for high spectral efficiency wireless communication employing multi-element arrays," *IEEE Journal on Selected areas in communications*, vol. 17, no. 11, pp. 1841-1852, 1999.
- [21] D. Tse and P. Viswanath, *Fundamentals of wireless communication*. Cambridge university press, 2005.
- [22] Y. Masumoto, "Global positioning system," ed: Google Patents, 1993.
- [23] A. Tsalgatidou and T. Pilioura, "An overview of standards and related technology in web services," *Distributed and Parallel Databases*, vol. 12, no. 2-3, pp. 135-162, 2002.
- [24] M. Morioka, Y. Yonemoto, T. Suzuki, and M. Etoh, "Scalable security description framework for mobile Web services," in *Communications, 2003. ICC'03. IEEE International Conference on*, 2003, vol. 2, pp. 804-808: IEEE.
- [25] K. Michael, "The Social Implications of Emerging Technologies," 2010.

- [26] Y. F. Chang, C. Chen, and H. Zhou, "Smart phone for mobile commerce," *Computer Standards & Interfaces*, vol. 31, no. 4, pp. 740-747, 2009.
- [27] T. Gneiting and A. E. Raftery, "Weather forecasting with ensemble methods," *Science*, vol. 310, no. 5746, pp. 248-249, 2005.
- [28] S. M. Paras, A. Kumar, and M. Chandra, "A feature based neural network model for weather forecasting," *International Journal of Computational Intelligence*, vol. 4, no. 3, 2009.
- [29] H. R. Glahn and D. A. Lowry, "The use of model output statistics (MOS) in objective weather forecasting," *Journal of applied meteorology*, vol. 11, no. 8, pp. 1203-1211, 1972.
- [30] M. Bevis, S. Businger, T. A. Herring, C. Rocken, R. A. Anthes, and R. H. Ware, "GPS meteorology: Remote sensing of atmospheric water vapor using the Global Positioning System," *Journal of Geophysical Research: Atmospheres*, vol. 97, no. D14, pp. 15787-15801, 1992.
- [31] M. Iqbal, *An introduction to solar radiation*. Elsevier, 2012.
- [32] G. Marchuk, "Numerical methods of weather forecasting," DTIC Document 1970.
- [33] C. Chen, S. Duan, T. Cai, and B. Liu, "Online 24-h solar power forecasting based on weather type classification using artificial neural network," *Solar Energy*, vol. 85, no. 11, pp. 2856-2870, 2011.
- [34] V. A. Orindi and S. H. Eriksen, *Mainstreaming adaptation to climate change in the development process in Uganda* (no. 15). Acts Press, African Centre for Technology Studies, 2005.
- [35] G. A. Watch, "World Meteorological Organization," *Guidelines for the measurement of methane and nitrous oxide and their quality assurance*, 2003.
- [36] R. Victorine, "Building tourism excellence at the community level: Capacity building for community-based entrepreneurs in Uganda," *Journal of Travel Research*, vol. 38, no. 3, pp. 221-229, 2000.
- [37] A. Lepp, "Residents' attitudes towards tourism in Bigodi village, Uganda," *Tourism management*, vol. 28, no. 3, pp. 876-885, 2007.