A Study on the Stratospheric Environmental Factors in the Philippines that Affects the Quality of Data Gathered in Launching Near Space Balloon

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ABSTRACT

Near space balloon is a technology that is getting widespread attention in other countries due to its promising benefits in comparison to the limitations of actual space exploration. Not to mention that the cost of launching satellite and the quality of data generated from space requires a lot of investment and technical requirement. Near space balloon which reaches the stratospheric level at a height of 200ft is a joint project of the College of Engineering and the School of Aviation in partnership with Microchip Technology Inc. This aims to provide an alternative solution of acquiring data at the said height which is more efficient in data gathering than satellite data due to its proximity from the ground station antenna. Also, the signal strength is higher at the said level. This project will use the Raspberry Pi ™as a module for the processing of data. The challenges of setting up the near space balloon relies on the accuracy of analyzing the environmental factor in the Philippines especially that we have intermittent strong winds that will be detrimental in the analysis of data.This study aims to present the environmental conditions of the Philippines in near space. This will contribute in the actual launching of the near space balloon.

KEYWORDS

Near Space, Near Space Balloon, NASA, Polyethylene, Raspberry Pi

1 INTRODUCTION

It is ordinary to know that every person during his childhood have experienced slipping a balloon whether by accident or not. It will fly up in the air until we see very little or nothing at all of the balloon. To some, that is natural. But for others, a second level of thought comes in- Where do the balloons go? Or how high could it have gone? Did it burst? After how long? Or did the balloon just lost the force to float and finally descend in an unknown place? The answer to these questions leads us to one of the most promising alternative to space exploration. The Near Space Balloon.

Near Space balloon is very straightforward in its definition. It is a kind of balloon which ascends at a height of at least 20 km to 1000 km. For those who are in the field of Avionics or Earth Science, this range of distance already dictates that this is within the stratospheric region. This height may not be reached by an ordinary balloon but the one used for this experiments are made of a special material called latex or polyethylene which could withstand changes in air pressure without bursting for a significant length of time.

The stratosphere is that layer of the earth that is above where commercial airlines travel but below the outer space region where satellites are launch. The stratospheric region according to study have very thin air making it not ideal for airlines due to high pressure but also not recommended for space exploration-the thinness of the air is not sufficient to provide the lift for heavy space craft. This on the other hand becomes very ideal for a near-space Balloon but only if it can withstand the pressure depending on the kind of material used for the balloon.

Also, one of the reason why near space is targeted is due to the other good attributes in this environment. First, there is less interference or none at all for physical airline traffic. And, since aircraft travel below this region, there is very little or no chance at all

where the balloon will bump on a physical object causing the balloon to burst. The wind in this region is also calmer putting the balloon in a much more stable and predictable position. The stability of its position is essential only if the balloon will not burst during flight at least within a few hours as part of the target of this project. Other near space balloon projects may span from a few hours up to several months depending on the needed to be covered by the balloon or the altitude of ascent. At this precise moment, the data gathered by the sensors installed in the balloon during flight will be sufficient to formulate engineering concepts.

2 BACKGROUND

There were several projects in the past and even up to this writing related to Near Space Balloon Projects. In NASA, they are accepting projects from graduate and undergraduate universities projects to fly their science and technology experiments to the edge of space on a scientific balloon mission. NASA is planning for a fall of 2016 HIagh Altitude Student Platform Mission (HASP) in Baton Rouge. Their projects ranges from Antartic Anticyclone Experiments, Radioation Experiment (RAD-X) and Hitchhiking to Mars reaching up to 120,000.

Other countries also have their own respective projects related to Near Space Balloon. Most of which travels at an altitude of 20-25 km high as shown in Table 1

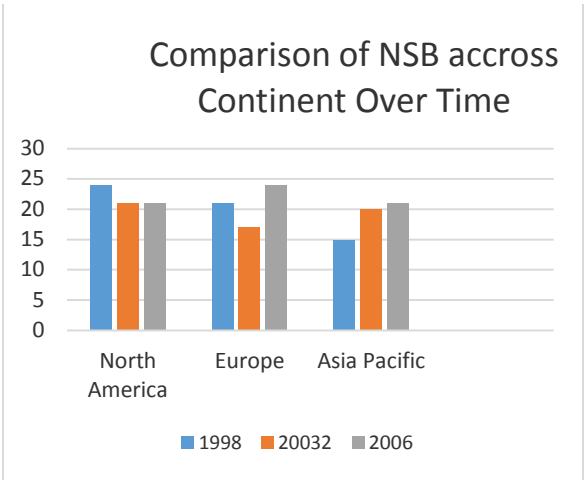

Table 1. Comparison of Near Space Balloons launched in different Regions of the World Over Time

One of the most remarkable projects is the Passive Ocean Remote Sensing in Near Space which capture data of the ocean to predict the possible occurrence of tsunamis and other ocean related disasters. This project is comparable to this in a way that the intention is to similarly predict possible occurrence of disasters whether tsunami or typhoon.

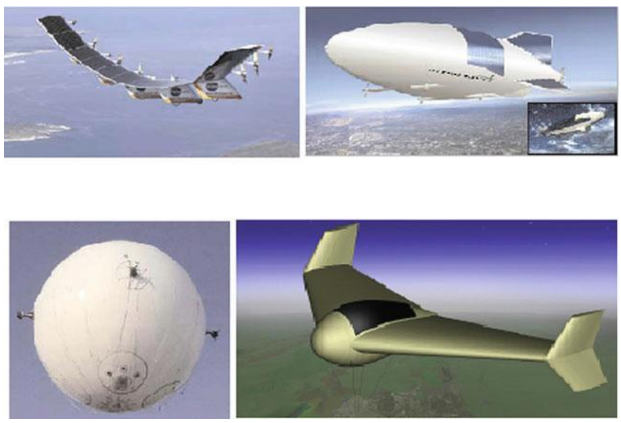

Figure 2. Other Near Space Balloon Projects

2.1 System Concept and Signal Models

The near space balloon which is to be launched by 2017 by a group of Engineers and Aviators, with application on the study of the Philippine Climate, it is intended that the balloon carries on its payload the following sensors and devices

- Raspberry Pi (for the data gathering and processing)
- High Altitude camera
- GPS Tracker
- Ham Radio Transceiver
- Altimeter and other sensors

Following the flight plan of other successful near space balloon projects, this will also be programmed for an altitude of 20km. This is way above the regular flight route of commercial airlines thus meeting the requirement of less interference. At the same time, this is below the space level where cosmic attenuation might the transmission of signals. The balloon will carry on its payload an estimated weight of 3000 grams. Using the Matlab software and the Fuzzy logic toolbox, the environment is analyzed and assessed to determine the altitude of the balloon. This will programmed with the use of Raspberry Pi in Linux Platform. Basically the formula for Buoyant force will be used to exact the predictability of the altitude of the balloon. Knowing that environmental forces interplay in the computation, Matlab through Fuzzy Logic will determine the best position

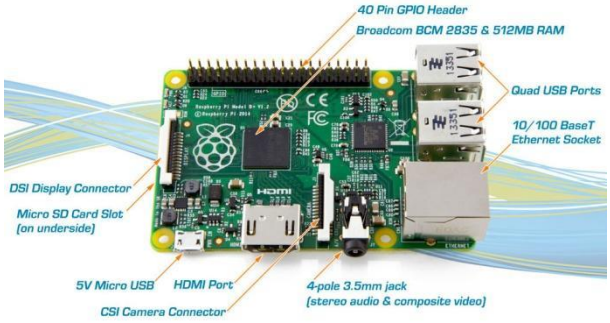

Figure 2. Raspberry Pi Model

6 RESULT EVALUATION

Understanding that the altitude of the balloon is affected by major factors like pressure, buoyant force and the weight of the payload, the altitude will be decided using the Fuzzy Logic Membership Function.

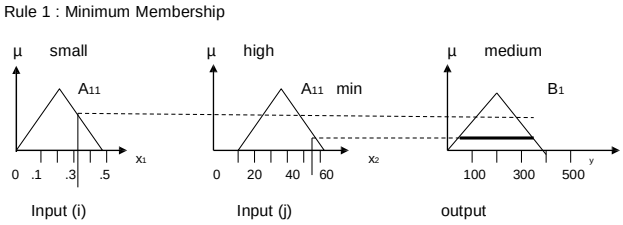

Figure 3. Fuzzy Logic Membership Function

Also the availability of a Matlab toolbox on Fuzzy Logic will also be used for its simulation.

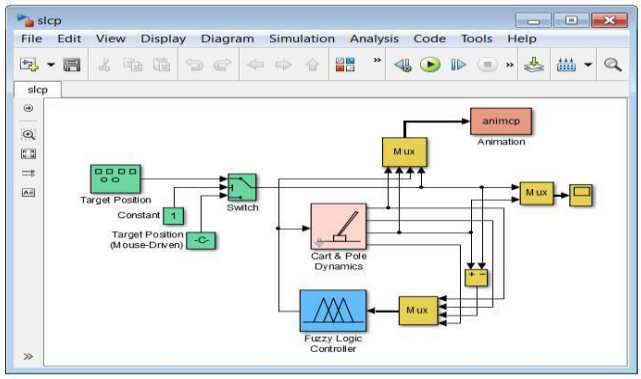

Figure 3. Matlab Fuzzy Logic Toolbox

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