

Prototyping Tools and Techniques with Reference to Design and Construction of CBSS 6m-Radio Telescope

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Abstract— Prototyping is an important technique to reduce the cost and risk involved in developing complex systems like the Radio or Optical Telescopes and other Astronomical Observatory tools. Basically, it includes designing a small scale version of a complex system in order to acquire critical knowledge required to build the real system. The prototyping process takes time, involves many persons and if inappropriate or inadequate knowledge is gathered it can lead project managers and end users to make false assumptions about vital characteristics of a system, thereby consequently setting up the stage for a project failure. In this paper, we focused on the basic design concepts adopted in the course of constructing an indigenous 6m Radio Telescope. We present various rapid prototyping techniques for exploring ideas quickly and inexpensively in the early stages of design, which is paper and pencil. Software prototyping techniques which require interactive simulations are briefly highlighted.

Keywords—astronomy, radio, space science, prototypes, telescope.

I. INTRODUCTION

Prototype is the first example of something like machine or industrial product from which all later forms are developed. In engineering, before building any equipment as in research, design, fabrication and development of Basic Space Science equipment in line with our Mandate at National Space Research and Development Agency (NASRDA)-Centre for Basic Space Science, University of Nigeria, it must be developed into a workable product. Therefore a prototype is a custom-built working example of a new design.

II. IMPORTANCE OF PROTOTYPING

As stated earlier, prototyping fundamentally means designing a small scale version of a complex system in order to get critical knowledge required to build the real system.

Prototyping Dimension

- Representation
- Precision

- Interactivity
- Evolution
- Participatory Design

III. PROTOTYPING CONCEPTS

Research and development is continued with the idea of building a model or copy to determine if they are technically feasible for the type of science that we want to do with it. Nevertheless, the initial prototype experience is to build up confidence in the potentialities of the system when completed.

Prototyping Strategies And Roles

Designers must decide what role prototypes should play with respect to the final system and in which order.

- Horizontal prototypes
- Vertical prototypes
- Task-oriented prototype
- Scenario-based prototypes

IV. GENERATION TECHNIQUES

These are rapid prototyping techniques for exploring ideas quickly and inexpensively in the early stages of the design. They include:

- A. *Paper-based (from pencil and paper to video)- This may include electronic versions of these tools such as drawings, paintings and text editors.*
- B. *Computer software-based (from fixed to interactive simulations).*

A. Paper-Based Prototyping Techniques

This is also called paper prototypes. It does not require a computer.

They include:-

- paper sketches
- Illustrated story-board
- Cardboards mock-ups

The following diagram is a paper prototype of the base of the mold for the construction of our 6m Radio Telescope.

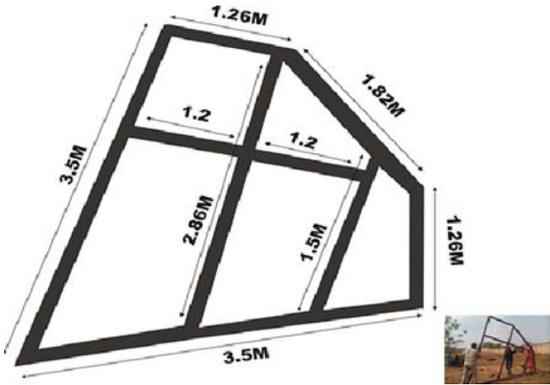


Fig.1: A paper and pencil prototype of the Mould base showing the dimensions



Fig. 2: Forming the base of the Mould using pencil and marker



Fig. 3: Forming the base of the Mould

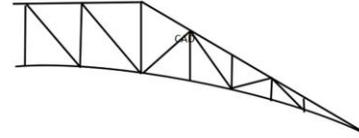


Fig. 4: A paper and pencil prototype of the rib



Fig. 5: Forming a rib on its Mould

B. Computer-Based Prototyping Techniques/Tools

These are always referred to as software prototyping tools mostly aimed at visual interfaces with user interface toolkits.. They are run on computer. They include:

- Computer animations
- Auto CAD
- Mat Lab
- Archi-CAD
- LabVIEW
- solidworks
- Interactive video presentations
- Programs written with scripting languages
- Applications developed with interface builders

The graph below shows pool out from MATLAB software used to determine the depth of the dish. The depth is 1m as indicated on the Fig. 6 below:

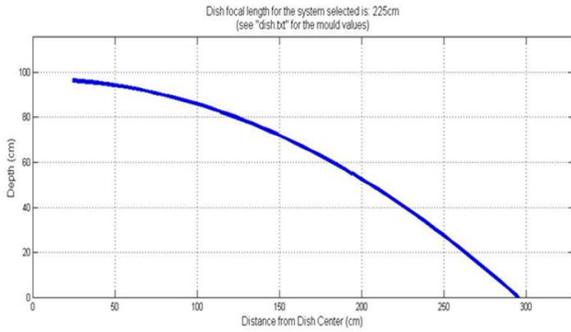


Fig. 6:



Fig.7: The finished mould for the ribs with a height of 1m.



Fig. 8: A segment of 11 ribs.

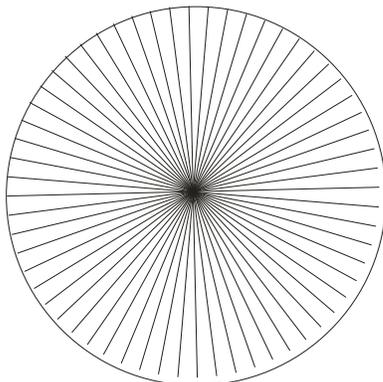


Fig 9: A paper-based prototype of the parabolic dish



Fig. 10: Ensuring a perfect parabolic surface



Fig. 11: The parabolic surface being covered by aluminium sheet

REFERENCES

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