Intelligent Antenna

Requirements Specification
Version <1.0>

Group: 01

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1   Introduction

This document discusses the requirements specification for an "Intelligent Antenna", a device which can change its direction according to the channel being watched.

1.1   Purpose

The document will provide the details on the behavior of the device, the requirements that will be full-filled by the device, and the constraints that will be met while designing and manufacturing the device.

1.2   Scope

The document will focus on the main functionality of the device and will cover the requirements expected from the system in detail.

The device is designed to be controlled using a normal TV remote. A manual control is also included to program the device, rotate the antenna and change channel. Device can be controlled manually using the buttons in the device. The stored channels are retained until manually erased. A wire is used to connect the control unit and the antenna. Only the information about current channel is shown.

1.3   Definitions, Acronyms and Abbreviations

EEPROM - Electrically Erasable Programmable Read-Only Memory

TV - Television

LCD - Liquid Crystal Display

iTenna- Intelligent Antenna

1.4   References

Motors - http://www.robotstorehk.com/motors/motors.html

Microcontroller - http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en010296

Display and Other Components - http://www.sparkfun.com/

1.5 Overview

This document elaborates on the basic functionality of the iTenna, the requirements that it should full-fill in various perspectives, and additional supporting information that is needed.

2 Overall Description

2.1 Product Perspective

Relative to a TV signal receiver the broadcaster's antenna's can be located in various directions. The signals can be received with maximum gain if the antenna can be rotated to the direction of the particular broadcasting tower whenever the channel is selected. The "iTenna" will do this task automatically. The device will let the user to program it and then will automatically rotate the antenna to the programmed direction when a channel is selected.

2.2 User Characteristics

This product is aimed toward general public and should be operable with minimal effort. Functionalities should be clear to be operated without any ambiguities.

2.3 Constraints

The device needs to work with existing television remote controllers. Since remote controllers are from different manufacturers' iTenna will have to decode different signal formats.

The device should be able to retain programmed channel settings after a power outage. Motor should be water proof and should be able to handle the weight of at least 2 standard antennas.

3   Specific Requirements

3.1   Functionality

3.1.1   iTenna Programming Support

The user should be able to store required direction on the target channel. User can select required channel using the TV remote, then rotate antenna in the target direction and save the setting in the iTenna's storage.

3.1.2   Rotate the antenna according to the channel being selected

When the channel is changed in the TV using the remote controller, signal is picked up by iTenna's controlling device. Then the antenna will be rotated to the previously stored position of the channel. If the channel is not programmed, the antenna will be kept in the current position.

3.1.3   360' Rotatability

The broadcasting station can be in any direction with respect to the antenna. So it is essential for the antenna to be rotatable in a full horizontal circle so that the antenna can be fine tuned to the direction of the broadcasting station.

3.1.4   Operation using a normal TV remote

The iTenna will detect a channel change by inspecting the output of the TV remote controller. Different manufacturers use different encoding mechanisms for remote controls. Therefore user should be able to select compatible mode according to TV manufacturer.

3.1.5   Functionality Indicators
The iTenna should display the channel that it is currently set to and it should provide indicators for other functionality such as Tuning, Manual/Automatic mode, etc.

3.1.6   Manual Rotation

User can rotate the antenna manually using the device in absence of a remote control. This enables the iTenna to be used with TV sets that don't have remote controller support. User can use hardware buttons built-in to switch between the automatic and manual tuning modes.

3.2 Usability

3.2.1 Feasibility of the product

As a product targeted at the general market iTenna should be sold with a reasonable price. If it costs a fortune to buy the device then the end users will not accept the product as a necessity. So the product cost should be kept under xxxx Rs. by taking necessary design decisions.

3.2.2 Ease of Use

Programming the iTenna for a channel is done after changing its mode to tuning. This can be done by pressing the tune button on iTenna. Then the antenna is rotated to the desired position and the location is saved. Most of the timing is spent on the rotating. Therefore the device can be programmed within a minute.

3.2.3 Regular usability of the remote controller

The usage of iTenna will be impractical if the user needs to change the way the remote controller is being used. The user should be able to point the remote controller at the TV and just press the number of the channel. If the user have to point it to the device or be with in a different distance to the TV than he/she currently uses the device then the user won't be comfortable using the device.

3.3 Reliability

Wide voltage range operatability

Most TV sets work in the 110V - 240V voltage range. So it is essential for iTenna to work in this region to make sure that it will work as long as the TV works.

3.4 Performance

3.4.1 Speed of Rotation

The speed of the motor is critical to set up the direction of the antenna correctly. If it turns very fast then the acceleration and the deceleration of the motor can harm the antenna. Also if it turns too slow then it will take a longer time to set the channel. So to maintain the proper balance between above mentioned criteria a speed of 360° per 5 seconds seems a good speed.

3.4.2 Dual antenna support

There are various types of antennas available in the market and support for the majority of these should be certified. So the motor that is used to rotate the antenna should be capable of rotating at least twice the weight of an average antenna.

3.5 Design Constraints

There are many brands of TV sets used in Sri Lanka, by vast range of manufacturers. It's impossible to support all remote control models. So we are targeting the most popular set of manufacturers as our supported models.

The device should have non-volatile storage to retain saved channels after a power outage. Therefore we have to use a Micro-controller with built-in EEPROM with capacity to save 100 channels.

Motor should be able to rotate in small steps to obtain needed accuracy and should be able to bear the weight of at least two standard sized antennas. Motor should be covered with waterproof casing to be protected from rain.

3.6 Components to be purchased

- Micro-controller
- Stepper Motor / Servo Motor / Motor with Optical Encoder
- Motor Driver
- Seven segment display
- Main PCB and other Components
- Components related to the power supply (Transformer, power regulator)
- Wires and other connectivity components

3.7 Interfaces

Infrared communication

The device communicates with standard infrared remotes operating at 36 KHz modulation frequency. Only one way communication (i.e listening) is used here.