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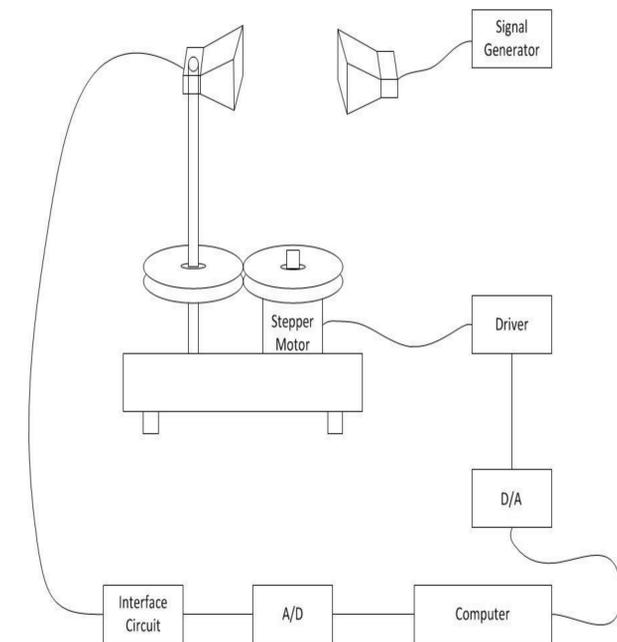
## Abstract

The project achieves a design and implementation of an automatic signal detection system. The system basically detects the direction of the source of an unknown signal and in case of multiple signals, the system detects the direction of the source of the strongest signal. Our system structure included transmitting an AC signal through a horn antenna, receive it then rectify it to find the maximum DC equivalent of the signal. Convert the DC output to digital and then convey the digital output to the computer through an interface circuit. The computer processes the collected data to find which direction the strongest signal come from. The computer afterwards sends a series of instructions to the stepper motor to control its motion and direct it toward the source of the strongest signal.

## Introduction

The antenna is a vital element in any wireless communication system. Therefore receiving the maximum power of the signal will enhance the data received by any communication system. In many communications systems nowadays a directional antenna is used to receive the signal strong if it was good aligned to its source. Accordingly a good alignment is an important issue. For instance, the TV antenna could be aligned in a specific direction to receive the signal from the satellite, but due to weather changes and fading the incoming signal will slightly change its direction, therefore instead of receiving 100% of the incoming signal a less percentage of the signal will be received which is reflected on the received data. But if an automatic signal detection system is attached to the antenna it will always keep the antenna aligned to the direction of the maximum incoming signal. Another important application for this system could be in airport towers in which signals received from airplanes is contentiously changing with time, therefore, the system can be used effectively here. Also, it can be used in Military field along with radar navigation and so on. In this stage the antenna rotate horizontally only but it can be modified in future to have vertical rotation as well. So, the project has good chances to be applied and developed in communication systems which will enhance the efficiency and reliability of communication systems.

## Project schematic



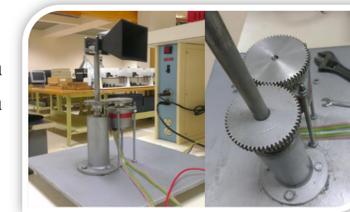
## Methodology

The project basically go through series of steps to achieve the goal and find the signal:

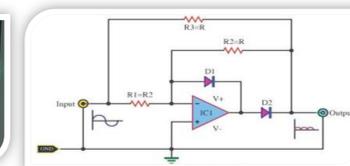
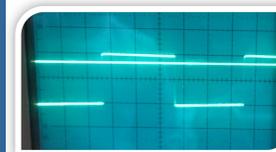
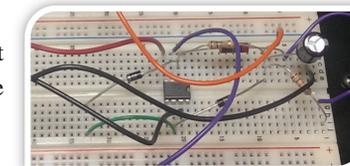
- 1- the antenna on the shaft receives a signal and pass it to the rectifier
- 2- The rectifier will rectify the signal and convert it into DC voltage which represents the strength of that signal.
- 3- an interfacing circuit of analog-to-digital IC will receive the DC value and convert it into digital numbers.
- 4- a software written in Visual Basic in the computer receives the number in digital format and compare it with the previous value.
- 5- the computer will send instructions to the motor to let it rotate one more step.
- 6- the previous steps are repeated in a loop until the maximum value is detected or the antenna complete one full rotation.

## Component

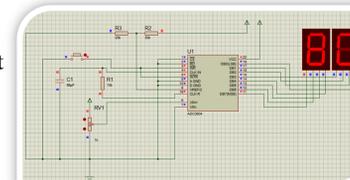
1- The stepper motor with the shaft and the horn antenna (mechanical part)



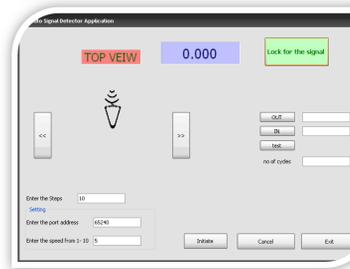
2- The rectifier circuit with the result on the oscilloscope.



3- The interfacing circuit of analog-to-digital IC.



4- The software interface



## Results

After we finished connecting the parts with each other, we had some difficulties in launching the system. After so many trials we finally were able to run the program and the antenna was able to detect the signal and point to its direction. We tested our project by comparing the values of the received data by the computer (in binary) and the output of the Analog to Digital Converter using the LEDs

## Conclusion

The automatic signal detection system has been achieved in time. The system we have built is now able to find the direction of any incoming signal and rotates the receiving antenna towards the strongest received signal. The project involves many electrical engineering specializations which we have gone through. Electromagnetic waves and antennas, electronics and digital in addition to the mechanical part can be considered parts of our project. In addition the computer program wrote in BASIC was one of the challenges we have faced in this project. The system we have produced is now working effectively and can be implemented as part of a bigger communication system whenever is needed. Our project could be improved in the next years to be more effective like sending messages for the nearest object or to guide the airplanes automatically. So our project opens new doors for the technology of automatic signal detection.

## Future Improvements

As we were working on the project, we came up with some great ideas for improving our project in the future. Here are some of them.

In our project, we designed the mechanical part to be able to detect any signal and point to the direction it is coming from in 2D scheme. That means, it can only rotate in a horizontal manner with 360 degree. Because of that, the main development we decided is to be able to extend the direction of a detected signal that are coming from a place that is higher or lower than the receiver. In other words, make our antenna rotate in a vertical manner in addition to the horizontal one. Also, the project objective is to point the direction of the highest signal only that is transmitted towards the receiver. We can improve it by make it trace the direction of the highest signal after it detect its direction. We can modify the program to allow the antenna to trace the signal for a certain amount of time, or make a switch to enable re-deduction of the highest signal and trace it again.

Finally, we can advance the project from not only being a direction detection device but a communication device too. In order to obtain this, we have to record the message and modulate it using AM modulation then transmit it. So instead of using a square wave in the transmitting side, we can use a message signal.