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Microcontroller Based Wireless 3D Position Control for Antenna

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Abstract: ***The idea is to develop a system which will control the movement of the dish antenna in all direction through an android application. The main application of using a dish is to receive signal from satellite and other broad casting sources. In order to position the dish to the exact angle to receive the maximum signal of a particular frequency it needs to be adjusted manually. In order to overcome the difficulty of adjusting manually, this proposed system helps in adjusting the position of the dish through an android application device. Remote operation is achieved by any smart-phone with android OS. The different directions of the dish are attained by using two servomotors, one move in vertical and other in horizontal direction. The servo motor actions are controlled by the micro controller.***

Keywords: Dish antenna, Microcontroller, Android, Raspberry PI

1. Introduction

Dish Antenna positioning or tuning is very important for getting standard broadcast signals from a satellite. The dish must be pointed at a precise angle to get the strongest possible signal. If the dish position is adjusted manually, it became too cumbersome to align it at the best possible position. Therefore, the required system is designed with an advanced technology in order to achieve the best possible position of the dish by remote operation. The main intention of this project is to control a dish position remotely using an Android application, which is capable of receiving the typical broadcast signals from the satellite. The main application of using a dish is to receive signal from satellite and other broad casting sources. In order to position the dish to the exact angle to receive the maximum signal of a particular frequency it needs to be adjusted manually.
IOT is used to communicate between phone and controlling system. The 'Internet Of Things' is the internetworking of physical devices, vehicles (also referred to as "connected devices" and 'smart devices"), buildings and other items-embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.

Raspberry pi processor uses most modern Mqtt IoT protocol to communicate with the mobile phone. The Raspberry Pi is a series of credit card -sized single-board computers developed in the United Kingdom by the Raspberry-pi foundation to promote the teaching of basic computer science in schools and developing countries. The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and Peripheral-device support. The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

2. Objective and Scope

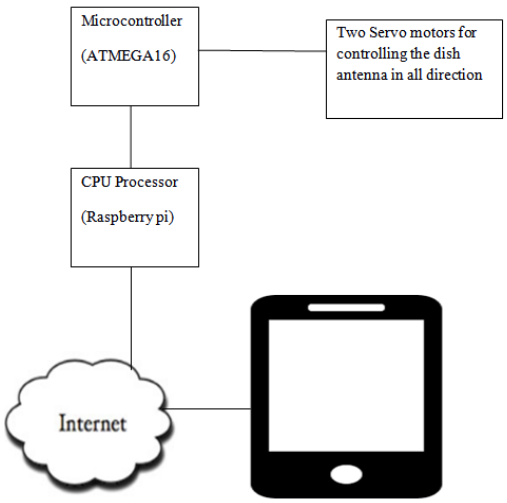
A. Objective

The Automatic Antenna Positioning system primarily functions to identify the source of signal. The signal may be of any type and any kind, it automatically /manually identifies the presence of a particular signal and the antenna will remain stationary as long as the signal link is established. Whenever the signal link breaks between the antenna and the satellite or source the antenna revolves continuously in search of the signal. This system also has advance connectivity with the monitor/LCD screen to indicate the antenna position.

B. Scope

The In modern world there is threat to perceptions to air defense from the enemy. Major establishments need to be guarded against any possible attack from the enemy. For this the automatic antenna positioning systems are necessary.

3. Detailed Block Diagram



C. AT mega -16

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

D. AVR studio

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The ATmega16 provides the following features: 16 Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 512 bytes EEPROM, 1 Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM; Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping.

The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run. The device is manufactured using Atmel's high density non volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional non volatile memory programmer, or by an On-chip Boot program running on the AVR core.

The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications. The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

E. Raspberry PI Basics

A complex IC that integrates the major functional elements into a single chip or chip set. It is a programmable processor with on chip memory and with accelerating function hardware (e.g. GPU).It has both hardware software and analog components. The advantages of using a system on chip is that it reduce overall system cost It has increase performance with low power consumption and reduce size.

F. Python

Python is a widely used high level, general- purpose, interpreted, dynamic programming language .Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of codes than possible in languages such as C++ or Java .The language provides constructs intended to enable writing clear programs on both a small and large scale.

Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library. Python interpreters are available for many operating systems, allowing Python code to run on a wide variety of systems. Using third-party tools, such as Py2exe or Py installer, Python code can be packaged into stand-alone executable programs for some of the most popular operating systems, so Python-based software can be distributed to, and used on, those environments with no need to install a Python interpreter. C Python, the reference implementation of Python, is free and open-source software and has a community-based development model, as do nearly all of its variant implementations. C Python is managed by the non-profit Python Software Foundation.

G. Embedded C

Embedded C is a set of language extensions for the C language programming by the C standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C

programming requires nonstandard extensions to the C language in order to support exotic features such as fixed point arithmetic, multiple distinct memory banks, and basic I/O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main ( ) function, variable definition, data type declaration, conditional statements (if, switch, case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc. Looking around, we find ourselves to be surrounded by various types of embedded systems. Be it a digital camera or a mobile phone or a washing machine, all of them has some kind of processor functioning inside it. Associated with each processor is the embedded software. If hardware forms the body of an embedded system, embedded processor acts as the brain, and embedded software forms its soul. It is the embedded software which primarily governs the functioning of embedded systems.

4. Working

We control the movement of the dish antenna in all direction through an android application. The different directions of the dish are attained by using two servomotors. The servo motor actions are controlled by the micro controller. The features of IOT are exploited to communicate between phone and controlling system. Raspberry pi processor uses most modern Mqtt IOT protocol to communicate with the mobile phone. The Raspberry Pi is a series of credit card -sized single-board computers developed in the United Kingdom by the Raspberry-pi foundation to promote the teaching of basic computer science in schools and developing countries. The android app also has the provision to show the current position of the antenna.

5. Advantages

1) An IOT application is used here, so that we can control the positioning of antenna anywhere in the world.

2) A large number of desired antenna headings may be stored in memory for subsequent use.

3) Can use any type of signals.

4) Range of detection can be increased.

6. Applications

1) To monitor any attacking objects.

2) In missile launching systems.

3) In monitoring of systems in satellite communication systems.

4) To monitor anti-missile systems.

5) In mass communication systems in moving vehicles.

6) In solar panels.

7. Conclusion

The automatic antenna positioning system primarily functions to identify the source of signal. The idea is to develop a system which will control the movement of the dish antenna in all direction through an android application. The main application of using a dish is to receive signal from satellite and other broad casting sources. In order to position the dish to the exact angle to receive the maximum signal of a particular frequency it needs to be adjusted manually. In order to overcome the difficulty of adjusting manually, this proposed system helps in adjusting the position of the dish through an android application device. Remote operation is achieved by any smart-phone with android OS. The different directions of the dish are attained by using two servomotors, one move in vertical and other in horizontal direction. The servo motor actions are controlled by the micro controller. Android application is developed in-order to control the motion of dish antenna. In the app we can provide the horizontal and vertical angle for rotating the dish antenna. The features of IOT are exploited to communicate between phone and controlling system. Raspberry pi processor uses most modern Mqtt IOT protocol to communicate with the mobile phone. The raspberry pi downloads the position information upload by the mobile through Mqtt. The controller uses the data collected from the processor to control the servo motor. This android app also has the provision to show the current position of the antenna. For this, the mobile downloads the data uploaded (Mqtt) by the raspberry pi about the current position.

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