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Wireless Sensor Based Energy Conservation via Bluetooth

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ABSTRACT:

Wireless sensor based control has drawn attention of many industries because of the reduced cost, easy mobility, easy maintenance, power management etc. Wireless Sensor based systems have been deployed in industries, army and in household for various applications such as monitoring, maintenance, security etc. In this project we discuss the use of wireless sensor technology (Bluetooth) for energy conservation, in which the sensor are deployed to sense and monitor the environmental conditions and take decision based on the inputs from the various sensors. A typical ARM chip can contain several peripheral controllers, a digital signal processor, and some amount of on-chip memory, along with an ARM core. Second, both ARM ISA and pipeline design are aimed at minimizing energy consumption — a critical requirement in mobile embedded systems. Third, the ARM architecture is highly modular: the only mandatory component of an ARM processor is the integer pipeline; all other components, including caches, MMU, floating point and other co-processors are optional, which gives a lot of flexibility in building application-specific ARM-based processors. Finally, while being small and low-power.

Index-Terms:

ARM11 processor, PIR sensor, LDR sensor, Relay, Arduino, Bluetooth module, etc.

I.INTRODUCTION:

Wireless sensor based control has drawn attention of many industries because of the reduced cost, easy mobility, easy maintenance, power management etc. Wireless Sensor based systems have been deployed in industries, army and in household for various applications such as monitoring, maintenance, security etc. In this project we discuss the use of wireless sensor technology (Bluetooth) for energy conservation, in which the sensor are deployed to sense and monitor the environmental conditions and take decision based on the inputs from the various sensors. In this project, we are giving the complete description on the proposed system architecture.

Here we are using Raspberry Pi board as our platform. It has an ARM-11 SOC with integrated peripherals like USB, Ethernet and serial etc. On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on XServer, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. The Raspberry Pi board equipped with the above software stack is connected to the outside network and a camera is connected to the Raspberry Pi through USB bus.

II. PROJECT IMPLEMENTATION:

2.1 BLOCK DIAGRAM:

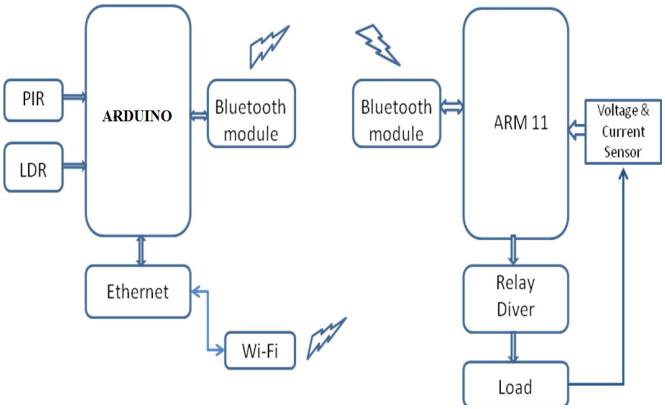

Figure-1: Block diagram

2.2 EXISTING METHOD:

In the existing system the Lab monitoring system is design and controlled by using RF technology which can monitor and control the system inside the lab only in places where network availability is more. They are bit more costly because cost of components is increased. Not so easy to implement as you have to take great care of noise, Because of antennas it is bulkier.

2.3 PROPOSED METHOD:

The proposed method is used to overcome the drawbacks present in existing method.

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Here we are using ARM Intelligent Monitoring Center which uses Samsung's processor as its main controller. The environmental conditions present inside the lab can be monitored using sensors like temperature, gas and LDR. All the sensors are connected to sensor board. From the sensor board we are sending monitored values to control room (ARM board) through RS232 serial cable. The serial cable is connected to one of UART port of ARM board. Whenever a person is entered inside the lab, the person's image can be captured by camera and send it to controller.

The controller transmits the data to remote PC through Ethernet by using FTP. FTP is a protocol through which users can upload files from their systems to server. Once data is placed at server we can view the data at remote PC (with internet) on web page with unique IP address. We can view continuous streaming of video as well as senor's data.

If we want to control the devices based on sensor's information we can control through web page from remote location using HTTP protocol. HTTP protocol continuously requests the server for control (turn on or turn off) the devices. In this way we can monitor and control the devices through remote PC.

III. HARDWARE COMPONENTS:

3.1 ARM11 PROCESSOR:

ARM is a 32-bit RISC processor architecture developed by the ARM Corporation. ARM processors possess a unique combination of features that makes ARM the most popular embedded architecture today. First, ARM cores are very simple compared to most other general-purpose processors, which means that they can be manufactured using a comparatively small number of transistors, leaving plenty of space on the chip for application specific macro cells.

A typical ARM chip can contain several peripheral controllers, a digital signal processor, and some amount of on-chip memory, along with an ARM core. Second, both ARM ISA and pipeline design are aimed at minimizing energy consumption — a critical requirement in mobile embedded systems. Third, the ARM architecture is highly modular: the only mandatory component of an ARM processor is the integer pipeline.

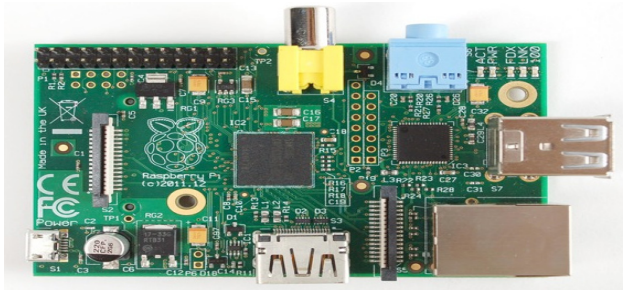

Figure-2: ARM11 processor

3.2 ARDUINO:

Segmenting code into functions allows a programmer to create modular pieces of code that perform a defined task and then return to the area of code from which the function was "called". The typical case for creating a function is when one needs to perform the same action multiple times in a program. For programmers accustomed to using BASIC, functions in Arduino provide (and extend) the utility of using subroutines (GOSUB in BASIC).

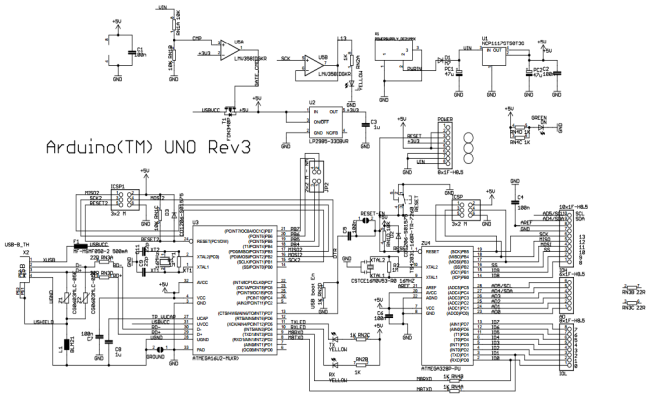

Figure-3: Schematic diagram

3.3 PIR SENSOR:

The modern world is filled with gadgets that get excited when they sense human motion. Automatic doors in elevators and shopping malls, burglar alarms at houses and shops, automatic lighting systems, electronic amenities in washrooms are just a few examples where human presence or absence puts the device into active or passive state. Now, what if we tell you that behind this smart response to motion is a gizmo that does not even reach the 2cm mark in size. Known as Pyroelectric or Passive Infrared Sensor (PIR, in both cases), this small electronic device is the curious case for this Insight.

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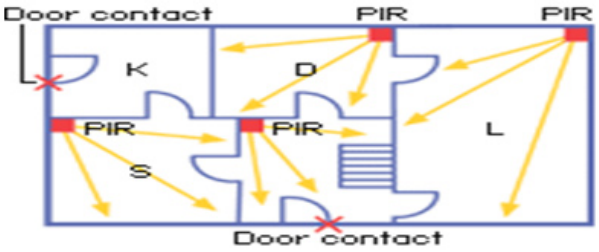

Figure-4: PIR sensor

3.4 LDR SENSOR:

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a LDR, one of the most commonly used symbol is shown in the figure below. A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity (Hence resistivity) reduces when light is absorbed by the material.

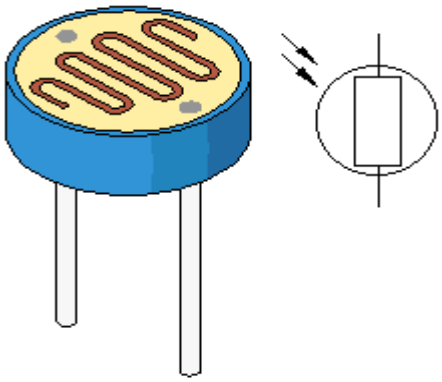

Figure-5: LDR sensor

3.5 RELAY:

A relay is an electrical switch that turns on or off, based on an external electrical signal. It is just like a normal switch that we see in our homes. The only difference is that instead of a human being switching it on or off, the switching is controlled via an external electrical signal. When the external signal is applied, the relay energizes and the switch is on, and when, the external electrical signal is removed, the relay is de-energized and the switch is off. There are two types of relays – mechanical, that are based on a coil and solid-state.

For most hobby work, you will deal with mechanical relays, since they are cheap and easily available as compared to the solid state relay.

3.6 EMBEDDED BLUETOOTH MODULE:

HC-05 is a class-2 Bluetooth module with Serial Port Profile, which can configure as Either Master or slave. a Drop-in replacement for wired serial connections, transparent Usage. You can use it simply for a serial port replacement to establish connection between MCU, PC to your embedded project and etc.

Figure-6: Bluetooth module

HC-05 embedded Bluetooth serial communication module (can be short for module) has two work modes: order-response work mode and automatic connection work mode. And there are three work roles (Master, Slave and Loopback) at the automatic connection work mode. When the module is at the automatic connection work mode, it will follow the default way set lastly to transmit the data automatically. When the module is at the order-response work mode, user can send the AT command to the module to set the control parameters and sent control order. The work mode of module can be switched by controlling the module PIN (PIO11) input level.

IV. RESULTS:

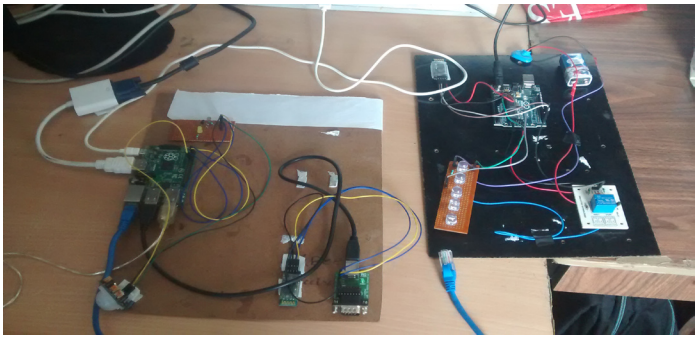

Figure-7: Hardware output of project

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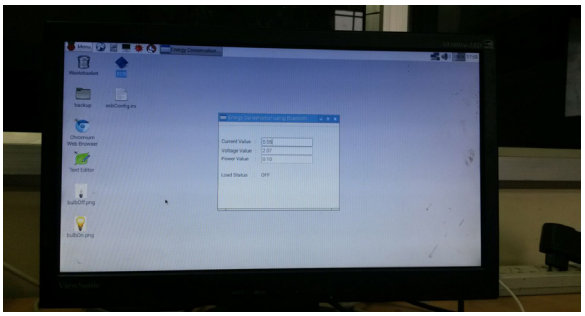

Figure-8: Output on PC

V. FUTURE SCOPE:

» The cost of ARM11 is more that's why in future we can implement this system using ARM CORTEX A8, Beagle bone etc as well as updated processors with high frequencies will work fine.
» As the storage space is also less in future we can also record these live streaming data by connecting external memory storage.
» We can complete our project using wireless technology.
» In future we can provide more security to data by using encryption, decryption techniques.

VI. CONCLUSION:

The project "WIRELESS SENSOR BASED ENERGY CONSERVATION VIA BLUETOOTH" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM Cortex A8 Processor board and with the help of growing technology the project has been successfully implemented.

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