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Wireless Sensor Network and Web Based Information System for Asthma Trigger Factors Monitoring

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ABSTRACT:

This project presents a web information system and a wireless sensor network for indoor or outdoor air quality monitoring with application in asthma trigger factors assessment. As the main target is mentioned the development of a flexible system characterized by a low-cost sensing nodes that assures robust and continuous monitoring of air conditions in order to prevent the asthma attacks. At the same time it permits to establish correlations between the air quality parameters and the appearance of respiratory diseases such as asthma as part of environment medicine approach. The wireless network includes a set of sensing nodes with ability to measure environment parameters like temperature, relative humidity, carbon monoxide among others and to send processed information to a smart coordinator. The primary processing is done by the smart coordinator that transmits the processed values of air quality parameters and heartbeat rate including alarms to a web based information system. Referring the web based information system it assures the human machine interface, the users being capable to receive alerts, and to visualize the data associated.

Index-Terms:

ARM11 processor, GAS sensor, Temperature sensor, GSM module, Arduino, Ethernet.

I.INTRODUCTION:

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. Immediately above the hardware sits the kernel, the core component of the operating system. Its purpose is to manage the hardware in a coherent manner while providing familiar high-level abstractions to user-level software. It is expected that applications using the APIs provided by a kernel will be portable among the various architectures supported by this kernel with little or no changes. The low-level interfaces are specific to the hardware configuration on which the kernel runs and provide for the direct control of hardware resources using a hardware-independent API. Higher-level components provide the abstractions common to all UNIX systems, including processes, files, sockets, and signals. Since the low-level APIs provided by the kernel are common among different architectures, the code implementing the higher-level abstractions is almost constant, regardless of the underlying architecture.

II. PROJECT IMPLEMENTATION:
2.1 BLOCK DIAGRAM:

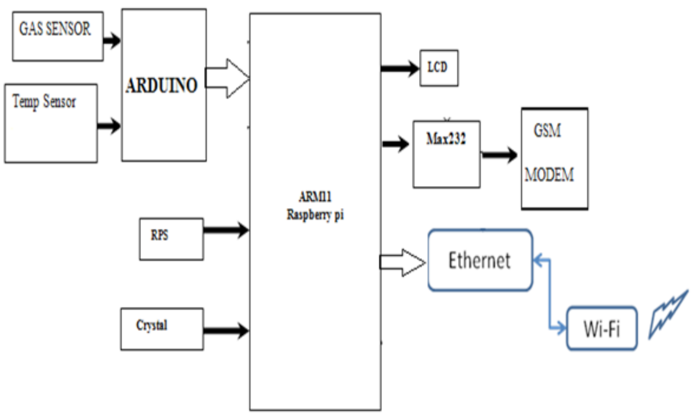

Figure-1: Block diagram

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2.2 EXISTING SYSTEM:

In the existing system, they have implemented using a short distance protocol of Zigbee, where has it is very limited range communication and not suitable for such applications where the person can move out the WSN network range.

2.3 PROPOSED SYSTEM:

The proposed system will developed around GSM technology, which is very long distance communication. The Monitoring system connected to human will continuously acquire the data from the sensor and transmits it over to the central server through GSM network which will analyze the values and if any factor are found that can trigger asthma then will alert the user using an SMS and the data will be posted to web for remote location view.

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.

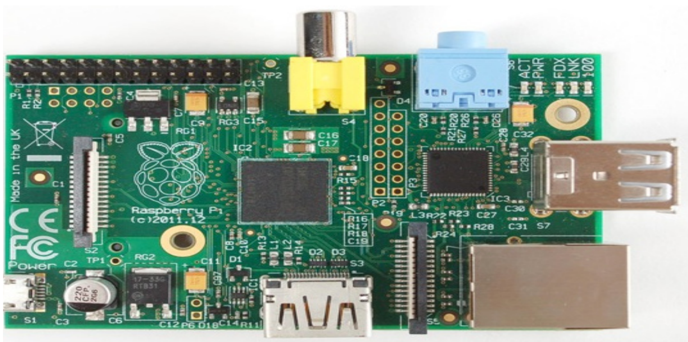

Figure-2: ARM11 processor

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).

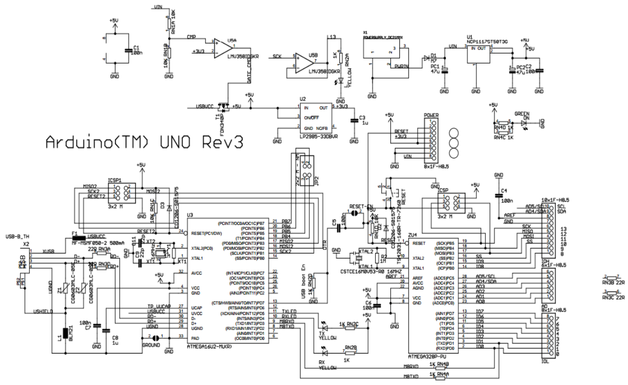

Figure-3: Schematic diagram

3.3 TEMPERATURE SENSOR:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level.

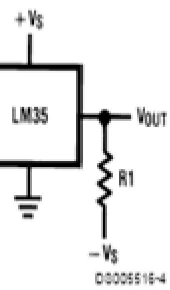

Figure-4: LM35 sensor

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3.4 GAS SENSOR:

MQ2 flammable gas and smoke sensor detects the concentrations of combustible gas in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm. The sensor can operate at temperatures from -20 to 50°C and consumes less than 150 mA at 5 V.Connecting five volts across the heating (H) pins keeps the sensor hot enough to function correctly. Connecting five volts at either the A or B pins causes the sensor to emit an analog voltage on the other pins. A resistive load between the output pins and ground sets the sensitivity of the detector. Please note that the picture in the datasheet for the top configuration is wrong. Both configurations have the same pin out consistent with the bottom configuration. The resistive load should be calibrated for your particular application using the equations in the datasheet, but a good starting value for the resistor is 20 kΩ.

Figure-5: Gas sensor

3.5 MAX232:

In telecommunications, RS-232 (Recommended Standard 232) is a standard for serial binary single-ended data and control signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors.

Figure-6: MAX232

3.7 GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION):

GSM (GLOPAL SYSTEM FOR MOBILE COMMUNICATION) is the most popular standard for mobile telephony systems in the world. The GSM Association, its promoting industry trade organization of mobile phone carriers and manufacturers, estimates that 80% of the global mobile market uses the standard. GSM is used by over 1.5 billion people across more than 212 countries and territories. This ubiquity means that subscribers can use their phones throughout the world, enabled by international roaming arrangements between mobile network operators. GSM differs from its predecessor technologies in that both signaling and speech channels are digital, and thus GSM is considered a second generation (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system.The GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators, who can choose equipment from many GSM equipment vendors. GSM also pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other mobile phone standards as well. The standard includes a worldwide emergency telephone number feature

3.8 ETHERNET:

Ethernet is a family of computer networking technologies for local area networks (LANs) commercially introduced in 1980. Standardized in IEEE 802.3, Ethernet has largely replaced competing wired LAN technologies. Systems communicating over Ethernet divide a stream of data into individual packets called frames. Each frame contains source and destination addresses and error-checking data so that damaged data can be detected and re-transmitted. The standards define several wiring and signaling variants.

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The original 10BASE5 Ethernet used coaxial cable as a shared medium. Later the coaxial cables were replaced by twisted pair and fiber optic links in conjunction with hubs or switches. Data rates were periodically increased from the original 10 megabits per second, to 100 gigabits per second.

IV. RESULTS:

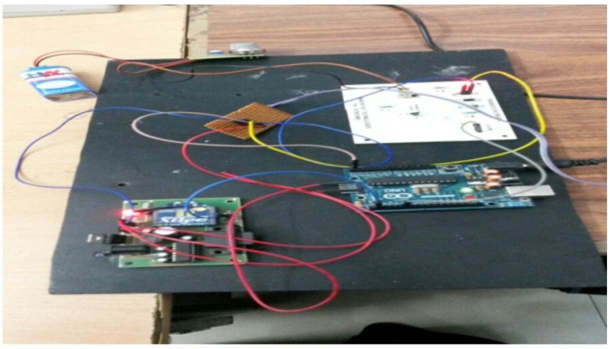

Figure-7: Hardware output of project

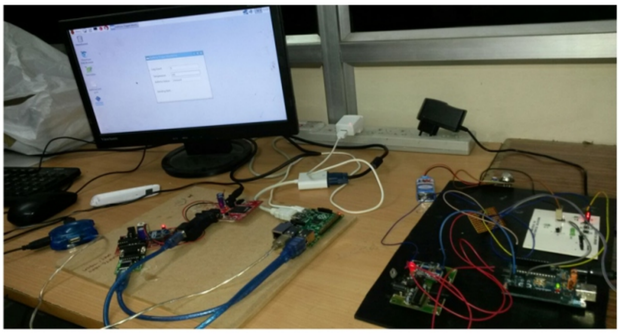

Figure-8: Output on PC

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 Network and Web based Information System for Asthma Trigger Factors monitoring" 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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