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Identifying Objects Using nRF2401 Transmitters & Receivers and Retrieving Data Using GSM

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ABSTRACT

Finding or Determining the exact location of any object that resides on earth surface or estimating the physical location of tagged objects in an interrogating area is nothing but Localization. This system is propose for monitoring instruments present in laboratory and provides monitoring and locating objects using Nordic semiconductor Radio Frequency (NRF) transmitters and receivers, and querying about the objects using mobile phones.This system contains NRF transmitters that are tagged to the objects and Mobile phones are used to query the location of the tagged object and Mobile phones are used to query the location of the tagged object. System sends a message to the Subscriber Identity Module (SIM), which is connected to a Global System for Mobile Communications (GSM) modem. This GSM Module collect the location information send it back to the system.

Keywords: Nordic Semiconductor Radio Frequency (NRF), Transmitter, Receiver, GSM, SIM

I. INTRODUCTION

Finding exact location of an object is nothing but Localization, there are two type of localization, indoor or outdoor. Different approaches are used like Global Positioning System (GPS used for outdoor applications), Radio Frequency Identification System (RFID by which items are uniquely identified using radio waves), and Near Field Communication (NFC used for outdoor as well as indoor applications) etc [1]. The process of determining the unknown position of an object based is the localization, and in the real-time localization system (RTLS), Global Positioning System (GPS) is perhaps the most famous example, a system that determines the position in real-time [2, 3].

If objects are equipped with Bluetooth or Infra-Red facilities then they can be easily located, and commonly found in electronic devices likes Personal Digital Assistant (PDA), laptops. But these systems are having drawback of limited range. But we extending this idea of locating object to the next step i.e. using NRF transmitters and receivers are used with greater range. This proposed system is a novel approach in locating and also retrieving product related information using mobile phones. Implementation of proposed system is based on three criteria, first one is objects/ nodes are connected wirelessly to node monitoring unit, monitoring unit continuously monitor instrument present in range of signal and GSM interface provides the user access to get information about specific instrument/object location.

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II. LITERATURE SURVEY

Wireless modules are required for the wireless sensor network or transceiver system and various wireless modules are available in the market with different range and different features. RF having different modules likes HC-05, ZigBee, Si4430, RFM12B, and NRF24L01. Here we choose Nordic semiconductors because testing area distance is approximately 10-30m. This module provides various features like 2.4GHz ISM band operation, Up to 2Mbps on air data rate, Ultra low power operation, 1.9 to 3.6V supply range, 6 data pipe MultiCeiver, Automatic packet handling, and On chip voltage regulator[4].

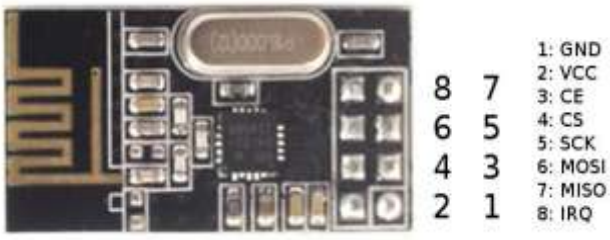

Figure 1 NRF24L01 [4]

Global System for Mobile Communications (GSM) is a standard developed by the European Telecommunications Standards Institute (ETSI). This GSM system describes the protocols for second-generation (2G) digital cellular networks, which is used by mobile phones. A GSM modem accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone and it is a specialized type wireless modem that works with a GSM wireless network. It may be an external device or internal device like a PC Card / PCMCIA Card and it sends and receives data through radio waves [5]. ATMEGA8 IC is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture and executes powerful instructions in a single clock cycle (130 Powerful Instructions)[6]. Provides 32 x 8 General Purpose Working Registers and Fully Static Operation as well as Up to 16 MIPS Throughput at 16 MHz. It provides two 8-bit Timer/Counters with Separate Prescaler, one compare feature.

III. ARCHITECTURE

The propose system i.e. 'Identifying Objects using nRF2401 and retrieving data using GSM' is based on Wireless sensor network (WSN) and consists of three parts; Base node which is attach with the instrument being monitor, Node monitoring unit with database software and GSM controller for information data retrieval, as shown in the figure a,b,c respectively. Nodes are connected wirelessly to node monitoring unit which must be installed in laboratory. The monitoring unit continuously monitor instrument present in range of signal or lab. As any instrument goes beyond signal range or lab its status is updated in monitoring unit along with time and date. This will help to find instrument usage in particular lab. By using log details we can track instrument if it is lost. GSM interface provides the user access to get information about specific instrument location in which lab it is. Just by GSM messaging any one can track instrument location from anywhere.

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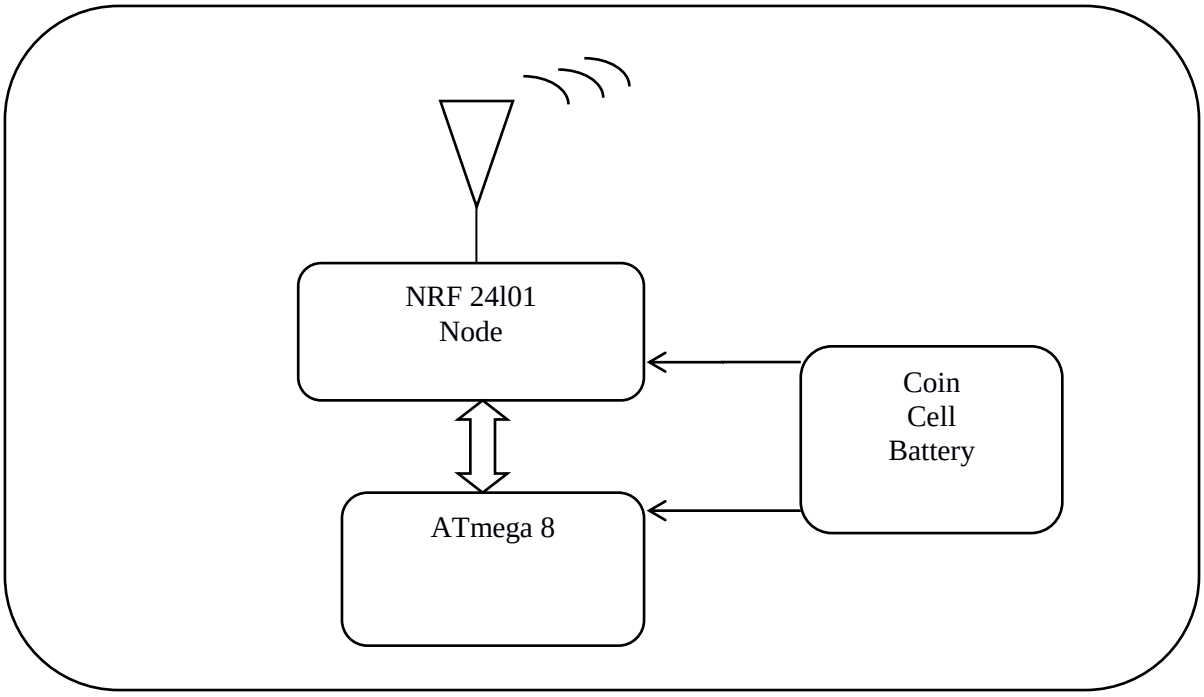

Figure a Node Block Diagram

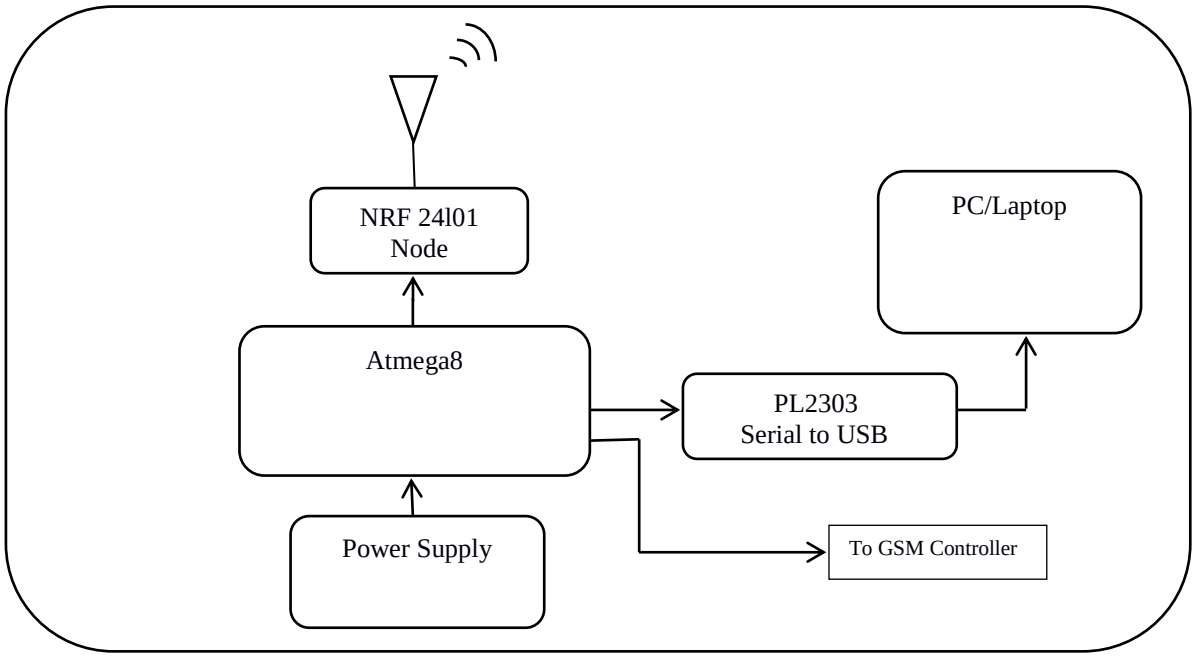

Figure b Block Diagram of Node Monitoring Unit

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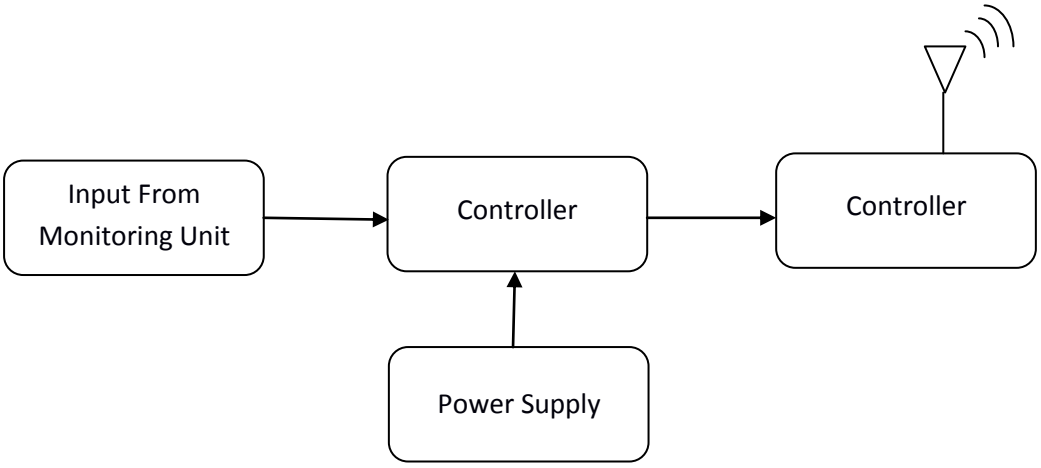

Figure c Block diagram GSM Controller

In this system we have to attach node to instrument being monitor, so the basic requirement specification of node is it should be small in size. Second is it should consume very less power. It should be battery operated. There are number of devices & various technologies for wireless communication as describe in literature survey. We selected nRf24l01 for wireless communication as shown in figure a. The node monitoring unit is central part of overall system. Every node within lab is connected to Monitoring unit wirelessly by nRf2401. The monitoring unit scans the nodes available and sends the information data to PC/Laptop by serial port. The controller used here is Atmega8 and it has only one serial port. That's why we need another controller board to interface with GSM modem as shown in figure b. To facilitate user for getting information from system GSM modem used. User can interact with system by SMS service option of GSM modem. GSM 590E model is used in system. M590 pure-data Communication Module is an ultra-compact GSM/GPRS industrial wireless module, optional Dual-band or Quad-band. It provides a high-quality SMS, GPRS data connection for use in industrial and commercial fields.

IV. RESULT

The practical experimentation done on implemented hardware and software and results are obtained. The monitoring unit consists of PC/Laptop and Visual Basic programming language is used for developing application with database. Node monitoring unit hardware interfaced with PC using USB to serial bridge PL2303. Application receives data from USB port for which hardware is attached and this incoming data contains the three types of information field like Location in which Laboratory Instrument / Device is present, Name of instrument/Device to which node is attached and Time, date. Using this information data is represented in graphical user interface in windows form for interfacing with hardware. Figure D the current status of Instruments i.e in which lab it is. After receiving next update previous information we can see in log window.

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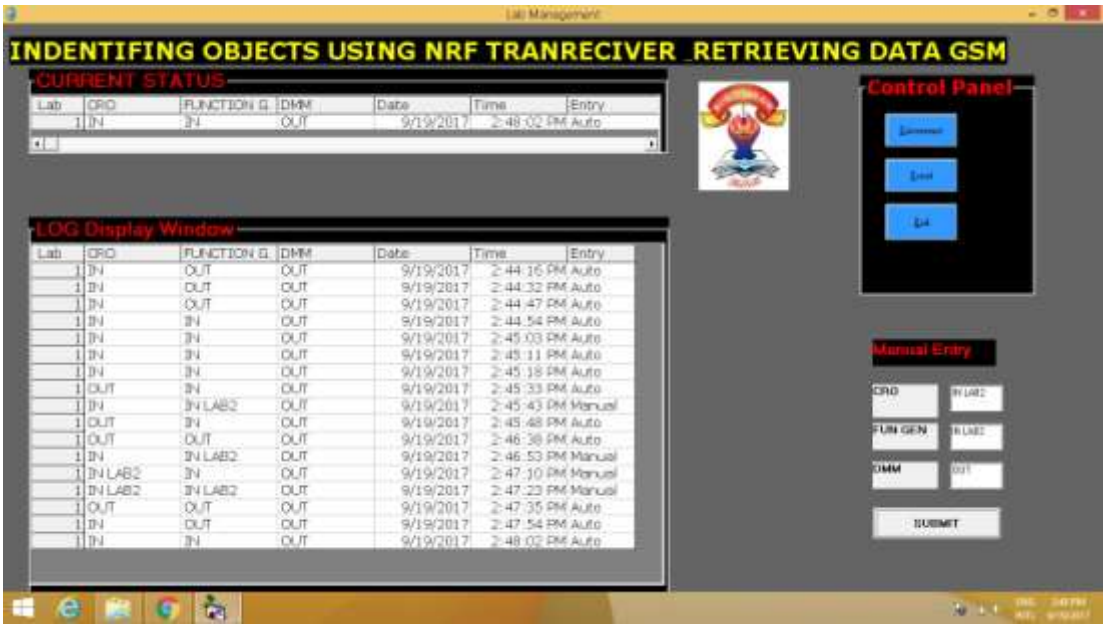

Figure D Screenshot of software user interface with obtained data

Also the practical experimentation carried out on GSM controller to test its operation, where Monitoring unit and GSM controller programmed using Ardiuno IDE open source hardware and software. This system programmed to respond using keyword (Instrument name) we typed SMS and send to it. Reply SMS is obtained with information which is correct as per the status showing in monitoring unit. Figure e shows the Software use for microcontroller programming and compiling.

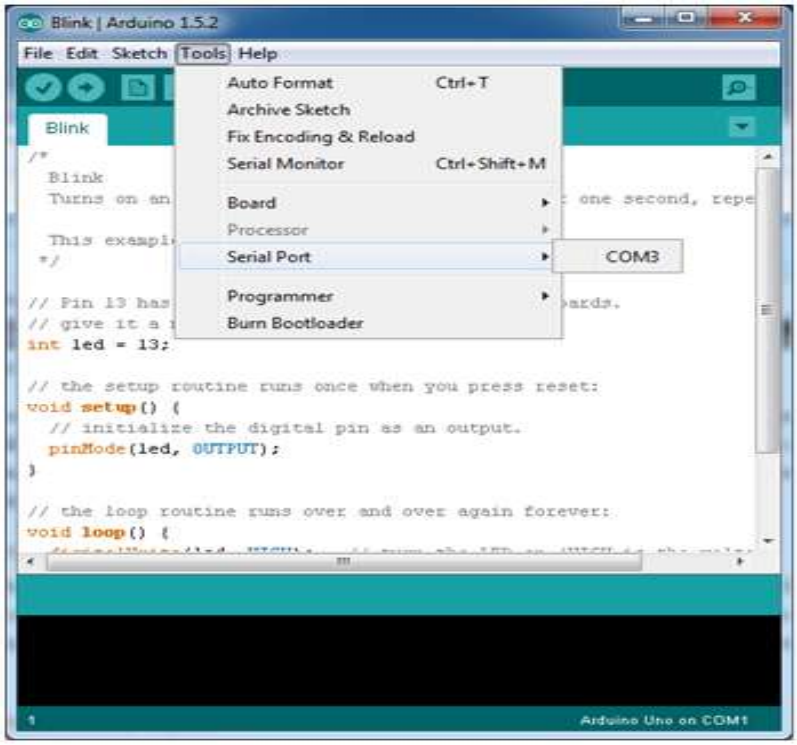

Figure e Software use for microcontroller programming and compiling

V. CONCLUSION

The system designed here using low power nRF24 wireless module is useful for tracking objects like lab instruments. Nodes design using nRF24 are small in size high data rate makes it best choice for object tracking system. For battery operated nodes tracking range is about 30 feet. These nodes are applicable where required low cost Node. The proposed provides many advantages like Low power required for wireless Node, small size nodes, multiple transmitters with single receiver, Node tracking range can be adjusted by varying gain and Database update continuously create history log.

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