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Personal Lung Function Monitoring Devices for Asthma Patients

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ABSTRACT

Asthmatics experience difficulty in breathing and airflow obstruction caused by inflammation and constriction of the airways. Portable peak flow meters are available but are inconvenient to use. We have created a user-friendly, accurate, and portable external mobile device accessory that collects spirometry, peak expiratory flow, exhaled nitric oxide, carbon monoxide, and oxygen concentration information from patients after two breath manoeuvres. We have also developed a software application that records and stores the gathered test information and mail the results to a physician. Telemetric capabilities help physicians to track asthma symptoms and lung function over time, which allows physicians the opportunity to make appropriate changes in a patient's medication regimen more quickly. Here we use a remote monitoring device that measures asthma levels as well as environmental level using gas sensor. Here the values of the sensors continuity flow to the doctor if there is any emergency condition occurs doctor will press alert key, it will automatically play the message to the nearby hospital using GSM and Bluetooth module.

Keywords : physician, GSM, Bluetooth Module

I. INTRODUCTION

Asthma is a chronic disease and a growing health problem worldwide. The objective of this pilot study was to test the feasibility and utilization of tracking asthma symptoms through an innovative mobile phone application providing health care. It is therefore important to develop accurate devices to monitor the disease symptoms so doctors can take appropriate steps to treat the patient with proper medication. One effective way to track asthma symptoms is to monitor a patient's peak expiratory flow (PEF). Many current PEF meters are inaccurate, inconvenient to use, bulky, expensive, and rarely include real-time data plotting capabilities. We have created a user-friendly, accurate, and moderately inexpensive external mobile device accessory that records and stores the user's PEF. Traditional methods of monitoring, such as manual asthma diaries, have not been very successful largely because these methods require more effort and commitment than most patients can easily devote. The efficacy of an asthma monitoring plan using PEF decreases, however, when patients deviate from their prescribed medical action plan or fail to follow the plan entirely. Here the values of the sensors continuity flow to the doctor if there is any emergency condition occur doctor will press alert key, it will automatically play the message to the nearby hospital using GSM module and we also use a camera to monitor the patient.

II. TRANSMITTER SECTION

CO2 Sensor: This instrument used for measuring carbon dioxide gas. Measuring CO2 is the important monitoring for asthma patients. Sends an analog signal that increases as the concentration of CO2 increases. This module also includes a digital output pin with TTL output. It has high sensitivity & stability. Operating voltage is 6v dc.

- Pressure Sensor: Pressure sensor can be classified in terms of pressure ranges they measure.
- Bluetooth Module: HC-O5 module is an easy to use Bluetooth SPP(serial port protocol).

It designed for transparent wireless serial communication. The HC-05 modules are very clever pieces of hardware, as they translate incoming bluetooth communication to serial data. So once configured this gives the tinkerer the possibility to achieve serial communication over Bluetooth.

The transmitter section is used as a mask in patient body. Aurdino, CO2 sensor, pressure sensor is fixed as mask. This Bluetooth module will be transmitter section which is HC-05. In transmitter section AVR is used as aurdino which has an 328 bit. Input of the aurdino will contain the value of the CO2 sensor and the pressure sensor. AVR will convert the values into a digitalized value. This digitalized value will be send to the Bluetooth module in the transmitter section. This Bluetooth module will give the values to the receiver section.

III. CONFIGURE AND PAIR TWO HC-05 BLUETOOTH MODULES AS MASTER AND SLAVE COMMANDS

In this Arduino Tutorial we will learn how to configure and pair two HC-05 Bluetooth Modules as Master and Slave devices. You can watch the following video or read the written tutorial below. In my previous two tutorials we already learned how to connect the HC-05 Bluetooth Module to the Arduino and make a communication between an Android smart phone and the Arduino. In those tutorials we used the HC-05 Bluetooth module with its default configuration, as a slave device.

A. Configuring the HC-05 Bluetooth Module at Command

For this tutorial we need to configure both modules. In order to do that we need to switch to AT Command Mode and here's how we will do that. First we need connect the Bluetooth module to the Arduino as the circuit schematics explained in the previous tutorials. What we need to do additionally is to connect the "EN" pin of the Bluetooth module to 5 volts and also switch the TX and RX pins at the ArduinoBoard.So the RX pin of the Arduino needs to be connected to the RX pin of the Bluetooth module, through the voltage divider, and the TX pin of the Arduino to the TX pin of the Bluetooth module.

Now while holding the small button over the "EN" pin we need to power the module and that's how we will enter the command mode. If the Bluetooth module led is flashing every 2 seconds that means that we have successfully entered in the AT command mode. After this we need to upload an empty sketch to the Arduino but don't forget to disconnect the RX and TX lines while uploading. Then we need to run the Serial Monitor and there select "Both NL and CR", as well as, "38400 baud" rate which is the default baud rate of the Bluetooth module. Now we are ready to send commands and their format is as following. All commands start with "AT", followed by the "+" sign, then a <Parameter Name> and they end either with the "?" sign which returns the current value of the parameter or the "=" sign when we want to enter a new value for that parameter.

B. Slave Configuration

So for example, if we type just “AT” which is a test command we should get back the message “OK”. Then if we type “AT+UART?” we should get back the massage that shows the default baud rate which is 38400. Then if we type “AT+ROLE?” we will get back a massage “+ROLE=0” which means that the Bluetooth device is in slave mode. If we type “AT+ADDR?” we will get back the address of the Bluetooth module and it should looks something like this: 98d3:34:905d3f.Now we need to write down this address as we will need it when configuring the master device. Actually that’s all we need when configuring the slave device, to get its address, although we can change many different parameters like its name, baud rate, pairing password and so on, but we won’t do that for this example.

C. Master Configuration

Now let’s move on and configure the other Bluetooth module as a master device. First we will check the baud rate to make sure it’s the same 38400 as the slave device. Then by typing “AT+ROLE=1” we will set the Bluetooth module as a master device. After this using the “AT+CMODE=0” we will set the connect mode to “fixed address” and using the “AT+BIND=” command we will set the address of the slave device that we previously wrote down.Note here that when writing the address we need to use commas instead of colons. Also note that we could have skipped the previous step if we entered “1” instead of “0” at the “AT+CMODE” command, which makes the master to connect to any device in its transmission range but that’s less secure configuration. Here you can find a complete list of commands and parameters: HC-05 AT Commands List. Nevertheless, that’s all we need for a basic configuration of the Bluetooth modules to work as a master and slave devices and now if we reconnect them in normal, data mode, and re-power the modules, in a matter of seconds the master will connect to the slave. Both modules will start flashing every 2 seconds indicating a successful connection.

IV. ADVANTAGES

Continuous monitoring is possible. Useful in emergency conditions.Relatively easy and quite easy to coordinate. Network failure affects the entire system.

V. FUTURE SCOPE

In the future work Technological advances in miniaturization together with progress in wireless communication allow for the development of miniaturized devices, integrated with clothes. Self-monitoring makes it feasible in almost all situations and locations.

VI. VI. CONCLUSION

The architecture of Arduino UNO based monitoring system for asthma patients. This project outlines the sensor development and instrumentation steps required to enables real-time collection of PEF data from patients onto computer, mobile phones etc.

VII. REFERENCES

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