Personal Lung Function Monitoring Devices for Asthma Patients

Elizabath Neema[1] Hafsiya T.H[2] Suchitra S[3] Ranjith Raju E[4]
[1,2,3]U G Student [4]Assistant Professor
[1,2,3,4]Department of Electronics and Communication Engineering
[1,2,3,4]Matha College of Technology

Abstract— Asthma affects over 300 million people worldwide. 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 e-mails 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 module.

Key words: ARP (Audio Play Recorder), PEF (Peak Expiratory Flow), ARM Processor, VNC Enable device

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. LITERATURE SURVEY

A. Personal Lung Function Monitoring Device for Asthma Patients Using ARM Controller

Monitoring the lung function is the preferred course of action to give physicians and asthma patients a chance to control the disease jointly. It is easy for the supervision of patients to use .Spirometry which is a device is currently the best way to capture a complete picture of air flow and the lung function during inhalation and exhalation of the patients..

B. GSM based self-monitoring system for asthma patient

To develop the personal lung function monitoring and telemetry devicethat can able to monitor and track asthma symptoms and lung function over time. Asthmatics experience difficulty in breathing and airflow obstruction caused by inflammation and constriction of the airways. Home monitoring of lung functions the preferred course of action to give physicians and asthma patients a chance to control the disease jointly. Thus, it is important to develop accurate and efficient asthma monitoring devices that are easy for patients to use.

III. PROPOSED SYSTEM

Here we discuss about monitoring device for the asthma patient. There are three sections, namely- transmitter section, receiver section and monitoring device. The transmitter section will be placed as a mask on the patient's face. The receiver section will be placed in the patient's room and monitoring device will be the doctor's room.

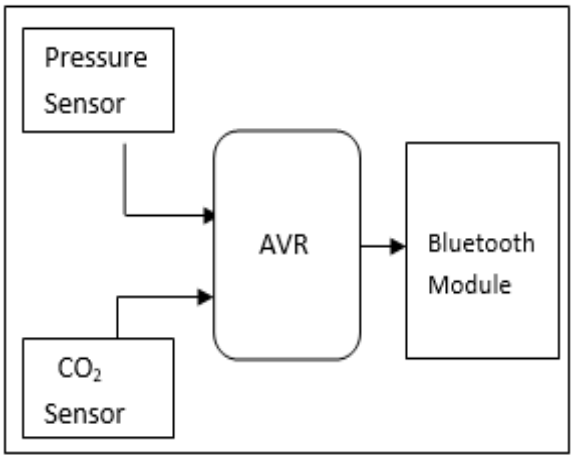

Fig. (1.1) TRANSMITTER SECTION

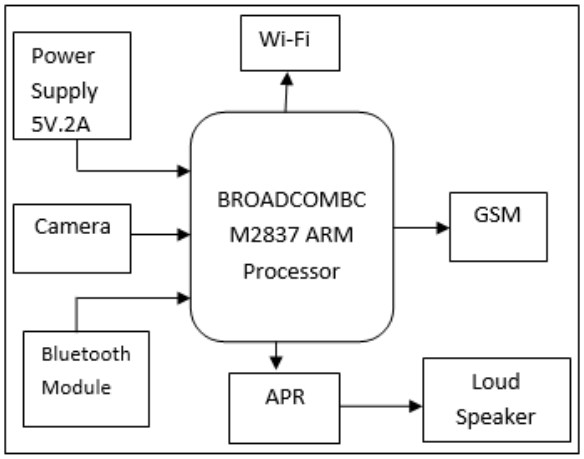

Fig (1.2) RECEIVER SECTION

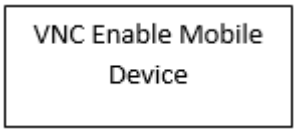

Fig (1.3) MONITORING DEVICE

Fig. 1: BLOCK DIAGRAMS

A. Transmitter Section

CO_2 Sensor: This instrument used for measuring carbon dioxide gas. Measuring CO_2 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.

B. Receiver Section

1) Raspberry Pi:

It is a series of small single band computer. CPU quart core is 64 bit ARM cortex A53 clocked at 1.25GH.its memory is 1GB. Output of video is occurred. We use BCM2837 ARM processor. This is the Broadcom chip used in the Raspberry Pi 3, and in later models of the Raspberry Pi 2. The underlying architecture of the BCM2837 is identical to the BCM2836.

2) APR:

APR (Audio Play Recorder) is a recorder is used for play audio. It is a audio recording & playback and voice recorder & playback. It have a 8Ch Voice recording. The total duration will be 11 Min Duration.

3) AVR:

It contains 328 bits. 1KBytes EEPROM. 2KBytes Internal SRAM. Write/Erase Cycles: 10,000 Flash/100,000 EEPROM. Power Consumption at 1MHz, 1.8V, 25°C. Active Mode: 0.2Ma.Power-down Mode: 0.1µA.Power-save Mode: 0.75µA (Including 32 kHz RTC). Operating Voltage: 1.8 - 5.5V. Temperature Range:-40°C to 105°C.

4) Wi-Fi:

Wi-Fi or Wi-Fi is a technology for wireless local area networking with devices based on the IEEE 802.11 standards. Wi-Fi is a trademark of the Wi-Fi alliance, which restricts the use of the term *Wi-Fi Certified* to products that successfully complete interoperability certification testing.

5) GSM:

GSM is a Global System for Mobile Communication. It is a digital mobile telephony system. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

C. Monitoring Device

VNC Enable Device: VNC enable device is a Virtual Network communication Device. It is used to monitor patient by camera output and sensor device. VNC is platform-independent – there are clients and servers for many GUI-based operating systems and for java. Multiple clients may connect to a VNC server at the same time. Popular uses for this technology include remote technical support and accessing files on one's work computer from one's home computer, or vice versa. There are a number of variants of VNC which offer their own particular functionality; e.g., some optimized for Microsoft windows or offering file

transfer (not part of VNC proper), etc. Many are compatible (without their added features) with VNC proper in the sense that a viewer of one flavour can connect with a server of another; others are based on VNC code but not compatible with standard VNC.

IV. INTERNAL SYSTEM ARCHITECTURE

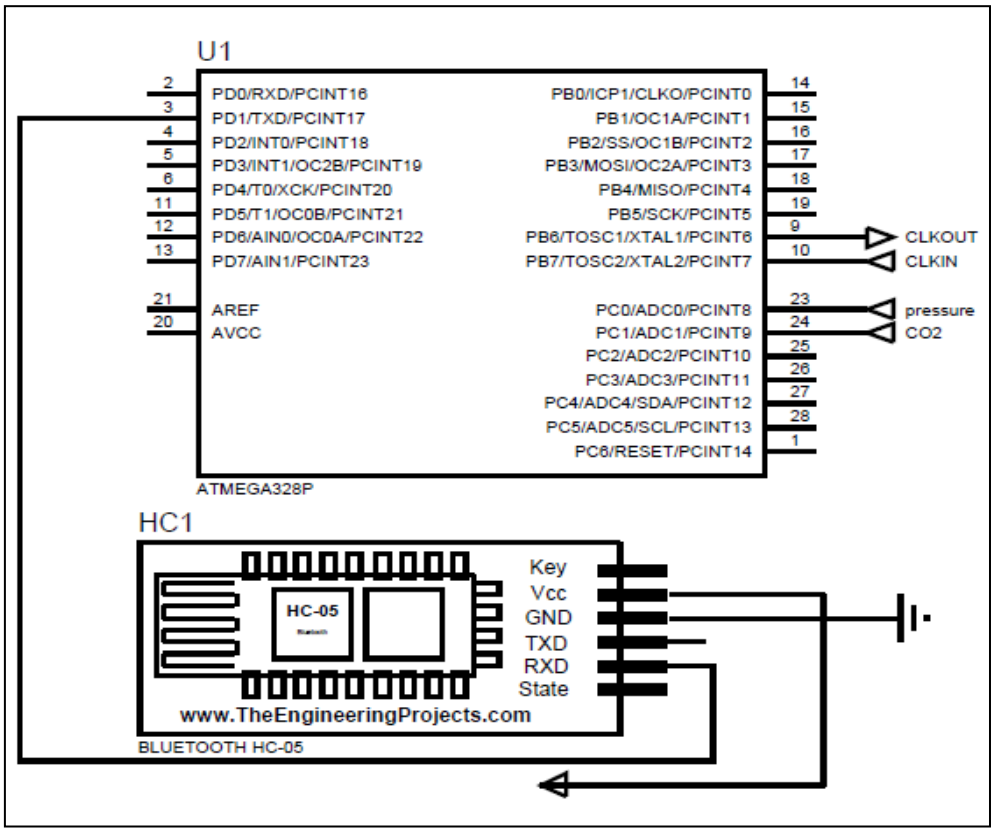

Fig. 2.1: Transmitter Section

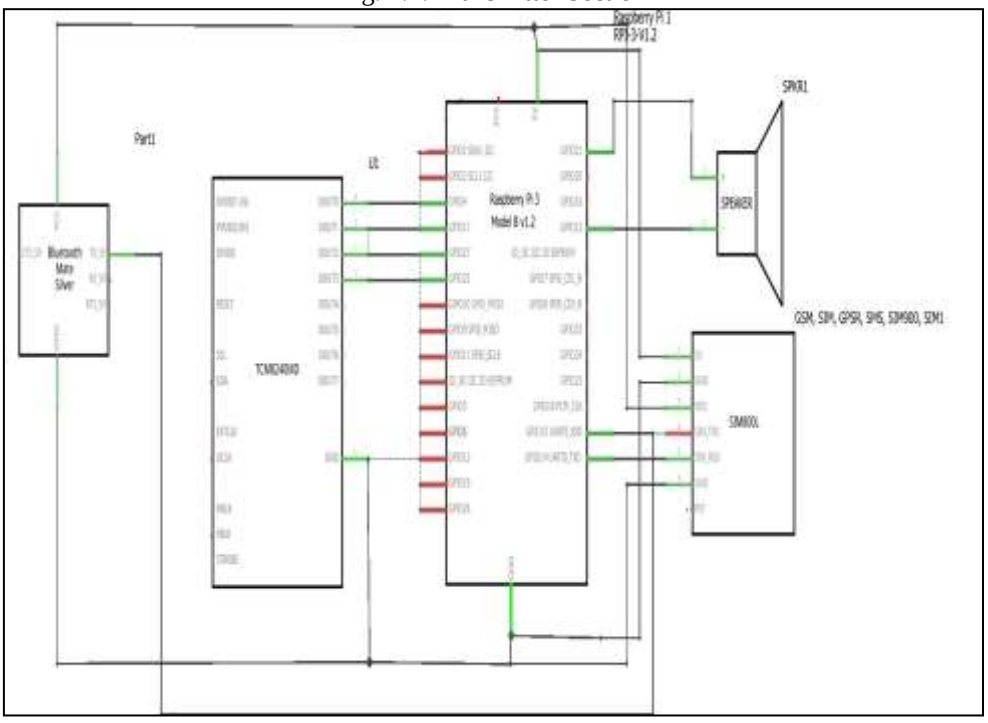

Fig. 2.2: Receiver Section

Fig. 2.3: Monitoring Device

The transmitter section is used as a mask in patient body. Aurdino, CO_2 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 CO_2 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.

The receiver section will be placed in the patient's room. This Bluetooth module will be the receiver section which is HC1. The raspberry pi which is used here will be the broad come BCM2837 ARM processor. There will be a wi-fi, power supply (5V, 2A), APR and it will be connected inside the raspberry pi. The power supply and wi-fi is the one which is used to turn ON the raspberry pi. The digitalized value of CO_2 sensor and pressure sensor, which is stored in receiver section of Bluetooth module, will be the input of the raspberry pi using a UAR communication protocol. If the threshold value which is stored in raspberry pi exceeds it will sends as SMS to the doctor. And doctor can see the patient and the reading through the camera by GSM module and doctor will give advice towards the patient through the GSM module.GSM module has the voltage of 12V, 2A. And this APR will be placed inside the raspberry pi and this APR is connected to the loud speaker. And patients can here the advice through the loud speaker.

The monitoring device will be placed doctor's phone which is VNC enable mobile device. Doctor can see the patient through the camera and he can read the reading then he will give advice to the patient by looking the condition of the patient through APR. In VNC there will be GUI icons is stored and they are take rest, take medicine and alert. Doctor can press any icon by looking the condition of the patient.

V. FLOW CHART

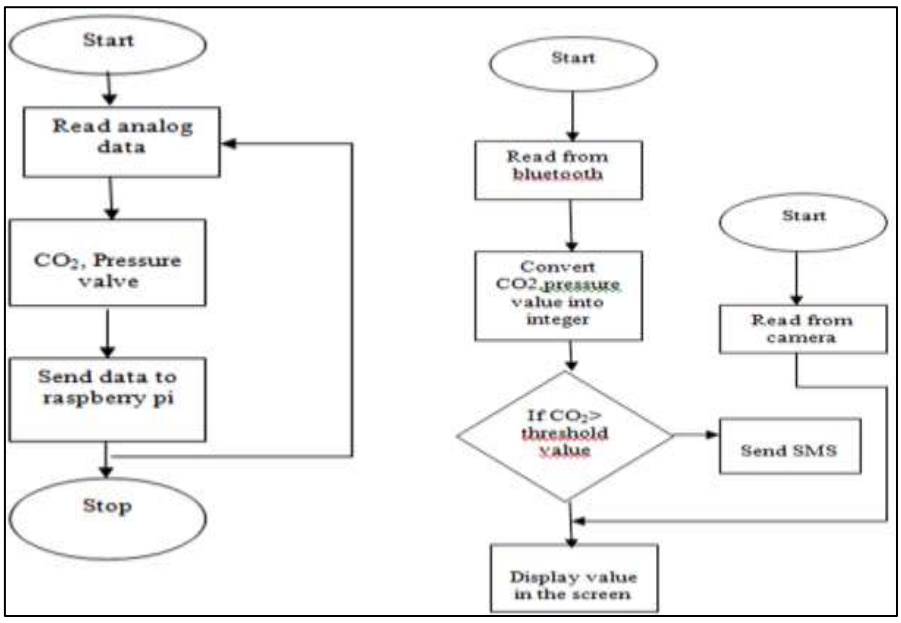

Fig. 3.1: Transmitter Section and Receiver Section

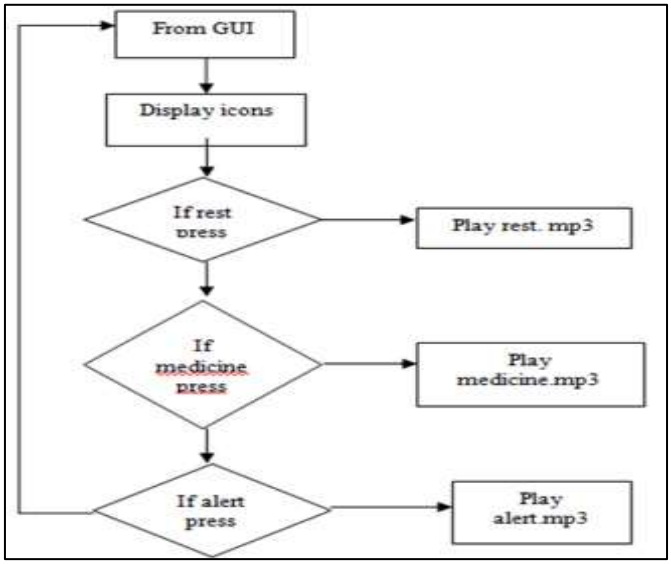

Fig. 3.2: MONITORING DEVICE

VI. SOFTWARE REQUIRED

The software we used here is 'python'. Python is a widely used high level programing for general purpose programing,. An interprented language Python has a design philosophy which emphasizes code readability and a syntax which allows programmers to express concepts in fewer lines of code 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.

VII. ADVANTAGES AND DISADVANTAGES

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

VIII. FUTURE SCOPE

In the future work technological advances in miniaturization and nano technology, together with progress in wireless communication allow for the development of miniaturized devices, integrated with clothes or even implanted in the human body. Self-monitoring makes it feasible in almost all situations and locations.

IX. RESULT AND CONCLUSION

This paper presents the architecture of raspberry pi 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.

Fig. 4: VNC Enable Device

REFERENCE

[1] B Saravana Manikandan1, U S Dharshana2, R Jaya Priya3, N Karthikeyan4 & S Kirubha Shri5―Personal Lung Function Monitoring Device for Asthma Patients Using ARM Controller.
[2] Prabhavathi.R , Mr.S.SANKAR M.E―GSM based self monitoring system for asthma patient.
[3] L. J. Akinbami et al., ―Trends in asthma prevalence, health care use, and mortality in the United States, 2001- 2010,‖ National Center for Health Statistics, Hyattsville, MD, USA, NCHS data brief, no. 94, 2012.
[4] S. R. Pitts, R. W. Niska, J. Xu, and C. W. Burt, ―National hospital ambulatory medical care survey: 2006 emergency department summary,‖ National Health Statistics, Hyattsville, MD, USA, Tech. Rep. 7, Aug. 2008, pp. 1–38.
[5] S. B. L. Barnett and T. A. Nurmagambetov, ―Costs of asthma in the United States: 2002–2007,‖ J. Allergy Clin. Immunol., vol. 127, pp. 145–152, Jan. 2011.
[6] B. Bloom, R. A. Cohen, and G. Freeman, ―Summary health statistics for U.S. children: National health interview survey, 2010,‖ Nat. Center Health Statist. Vital Health Statist., vol 10, no. 250, pp. 1–80, Dec. 2011.