

Assist Devices for Heart and Pulmonary Inflammatory Patients using Real-Time Wireless Network Systems

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Article Info

Volume 83

Page Number: 3199 - 3208

Publication Issue:

March - April 2020

Abstract:

The most common diseases found among middle aged people are heart and pulmonary inflammation related. In case of unpredictable heart dysfunctions at any time events, they require immediate medical attention to save their life. Saving the time in between is critical. Defibrillation is a procedure by which an electronic device gives an electrical sign to heart which can recapture hearts typical rhythm. It is performed to address hazardous arrhythmias and to prevent cardiac arrest. The initial segment of the paper intends to structure a framework which is fit for following the area of cardiovascular patients and furthermore checking of pulse alarms in the event of crisis through SMS to predefined numbers. In the present scenario implantable cardioverter defibrillator are used by cardiac patients for preventing sudden cardiac disorders. But only a few patients are able to implant ICDs because of its complex surgical procedures. The wearable defibrillator is an appropriate solution for those patients who cannot use implantable defibrillators. In the second part of the paper aims to design a portable device to monitor the severity of several lungs function parameters and record the data of pulmonary inflammatory patients (asthmatic). In this device consists of a chemical sensor pressure sensor and heart rate sensor. The electrochemical sensors are used to measure the nitrous oxide, oxygen, carbon monoxide. Information got by chemical sensor sent to the microcontroller that changed over a concentrated worth. This paper deals with providing a monitoring device which continuously monitors the asthmatic patients by using ZIGBEE. Now a days the classic defibrillator, spirometry and peak flow meter are used but they are non portable one and inconvenient to use. This work makes an easy to use, exact, versatile outer mobile device extra that gathers tolerant data with continuous home monitoring system and transferring the information by telemetric system and also delivers appropriate amount of shock to the patient and makes the heart rate normal.

Keywords: *Wearable Defibrillator, Asthma Monitoring Sensors, Portable External Mobile Device, Microcontroller, ZIGBEE.*

Article History

Article Received: 24 July 2019

Revised: 12 September 2019

Accepted: 15 February 2020

Publication: 21 March 2020

I. INTRODUCTION

Presently a day's innovation is running with time, and it totally involved the way of life of people. It is start utilized wherever in our every day life to satisfy our prerequisites. We can build the solace of life as well as increment the wellbeing observing systems

between utilizing cutting edge innovation. In this work we are utilizing innovation to detect genuine medical issues with the goal that productive therapeutic administrations can be given to the patient in fitting time. This paper aims in sending alert messages in emergency times ,i.e. when a person is alone in home or travelling and his heart

beat rises or lowers then alerting message will send to the mobile phone, the message consist of location of that person also. Additionally, we can get the pulse of the individual by basically sending a predefined position SMS. Here we get the cautioning message from the GSM modem and area of that individual can be finding with the assistance of GPS. The GPS is the abbreviation for worldwide situating framework. GPS gives position, speed time of anything situated on the earth. This GPS recipient is fit for recognizing the area in which it was available as scope and longitude. The GPS recipient gets the information from the satellites. The working of this device depends on reality that the blood level course during extension and compression of heart which can be detected by heart beat sensor. Depending upon the pace of dissemination of blood every second the heart beat every moment is determined. This device comprises of microcontroller which takes the contribution from the heart beat sensor and ascertains the pulse of patient. The microcontroller assumes the liability to sending ready messages through GSM modem at whatever point it is essential. A defibrillator is a device that is intended to reestablish a fibrillating hearts its typical electrical action, ordinary beat and subsequently it's typical movement and hence reestablishes the patient's life. Different sorts of defibrillator devices are known in the art both external defibrillators and internal defibrillators. Outer defibrillators will be Defibrillators that are put remotely on a patient out of luck and might be worked physically, for instance by a prepared medicinal staff. Other outer defibrillators might be worked naturally, for instance by untrained spectators. Some outer defibrillators may likewise start the defibrillation procedure consequently. The defibrillation procedure is regularly performed by electrical methods, by which an electrical vitality is conveyed to the heart, either remotely or inside. The electrical vitality applied to the heart might be monophasic (moving in one heading between the anodes) or biphasic (moving in the two bearings between the terminals). Defibrillation is performed in a subject after

detecting a heart related parameter and after getting guidance to perform defibrillation from a remote area. Technique for defibrillating that incorporates detecting a heart related condition; creating a sign after deciding a heart failure; Transmitting a sign demonstrative of a heart failure to a remote area and setting off a defibrillation after being enacted from the remote area. The wearable defibrillator joins a long haul electrocardiogram (ECG) observing framework with an outside programmed defibrillator. This is a sheltered and viable device to end ventricular tachycardia/ventricular fibrillation occasions, except if a cognizant patient retains stun conveyance. It might be utilized in patients in the early stage after intense myocardial localized necrosis with poor left ventricular capacity, after intense coronary revascularization methodology and decreased left ventricular launch portion ($\leq 35\%$), in patients with intense cardiovascular breakdown in non-ischaeamic cardiomyopathy of unsure etiology and forecast. This might be useful in subjects with syncope of accepted tachyarrhythmia starting point or in patients with acquired arrhythmia disorders. Rapid or irregular asynchronous contraction of heart muscles leads to fibrillation and this condition can be overcome by providing defibrillation. Defibrillation is a process by which an electronic device provides an electrical signal to heart which can regain hearts normal rhythm. It is performed to correct life threatening arrhythmias and to prevent cardiac arrest. In the present scenario implantable cardioverter defibrillator are used by cardiac patients for preventing sudden cardiac disorders. But only a few patients are able to implant ICDs because of its complex surgical procedures. The wearable defibrillator is an appropriate solution for those patients who cannot use implantable defibrillators. WCD is an automatic device placed close to the surface of the body .This device combines a long term ECG monitoring system and defibrillating circuit. The wearable Defibrillator is a safe and effective tool for terminating cardiac irregularities in an effective and efficient way. The core part of the wearable defibrillator is a microcontroller, here PIC

16F877A is used. It is interfaced with global positioning system and global system for mobile devices. GSM is a specialized type of modem that allows communication over the mobile network. The GPS module used in this system allows locating the position of the patient. Also the defibrillation circuit delivers appropriate amount of shock to the patient and makes the heart rate normal. ASTHMA is an interminable aspiratory incendiary sickness that influences the aviation routes. Pneumonic aggravation influences more than 300 million individuals around the world. Asthmatics experience trouble in breathing and airflow obstruction brought about by irritation and choking of the aviation routes. In excess of 5 million kids have asthma and the pervasiveness of asthma is more noteworthy than 15% for youngsters living in low-pay families. The seriousness of manifestations, triggers, and responsiveness to treatment medicine are regularly remarkable to every person. Along these lines, a far reaching rule for an asthma activity plan prescribes concentrating on checking asthma side effects as an objective for asthma treatment. Home observing of lung work is the activity to allow doctors and asthma patients to control the disease. Hence, it is imperative to create exact and proficient asthma checking devices that are simple for patients to utilize. While there are medicinal medications accessible to reduce asthma side effects, there is no fix. Individual checking of lung work is to control the illness by made an easy to understand, precise and compact outside device frill. This device gathers numerous parameters (breathed out nitric oxide, carbon monoxide, oxygen fixation, pulse, pressure rate) from understanding more secure two breath moves.

II. LITERATURE SURVEY

Shinet et al. proposed a novel, wearable cardiac monitor (in the future called WHAM) is proposed which permits a nonstop and continuous observing of user's cardiovascular conditions. The proposed device is made out of 3 fundamental parts: an expendable terminal, a controller, and individual

entryway (e.g., wireless, PDA, and advanced mobile phone and so forth.). The ECG signal is recorded by the surface Laplacian of the body surface potential. It is discovered that the WHAM shows enough possibility and has points of interest as a wearable mobile checking device in that the equipment is scaled down enough little to incorporate on a little district, in this manner no wire leads need[1]. Daniel et al. presented three new zero-control barriers dependent on RF control gathering .Three new zero-control protections dependent on RF control reaping is presented. Two of these protections are humancentric, carrying patients into the circle as for the security and security of their implantable therapeutic gadgets (IMDs). Our commitments give a scientific benchmark to understanding the potential security and protection dangers of present and future IMDs, and present human perceptible and zero-control alleviation strategies that address those dangers. As far as we could possibly know, this paper is the first in our locale to utilize general purpose programming radios to break down and assault already obscure radio correspondences conventions [2]. Mohamed Fezari et al. describethe improvement of a pulse screen framework dependent on a microcontroller. It offers the benefit of transportability over tape-based chronicle frameworks. The paper clarifies how a single chip microcontroller can be utilized to break down heart beat rate flag continuously. Likewise, it enables specialists to get the heart beat rate record of the patient by email each twenty four hours. It can likewise be utilized to control patients or athletic individual over an extensive stretch. The framework peruses, stores and examinations the heart beat rate flag dully progressively. The equipment and programming configuration are arranged towards a single chip microcontroller based framework, consequently limiting the size. The significant element of this paper is the utilization of zero swearing on calculations to figure all that is holy rate. It at that point forms on continuous the data to decide some heart infection. Tsuchiya et al. proposed heart rate checking innovation utilizing pneumatic

force sensor [3][4]. Yamamoto et al. proposes a practical appraisal arrangement of autonomic sensory system utilizing a gaseous tension sensor. The pneumatic force sensor can unconstrainedly distinguish fundamental data by setting it under the sleeping cushion in bed. We perform useful evaluation of autonomic sensory system by pulse fluctuation by the framework [5]. Larset al. presents a committed ultrasound framework to screen cardiovascular capacity consistently during and after heart medical procedure. The framework utilizes smaller than usual 10 MHz transducers sutured straightforwardly to the heart surface. M-mode pictures give a visual understanding of the withdrawal design, while tissue speed bends give point by point quantitative data. The ultrasound estimations are bolstered by synchronous ECG and weight accounts. The framework has been tried on pigs, exhibiting M-mode and tissue speed estimations of good quality [6]. Inaki, et al portrays the assessment and improvement of a beat location calculation that is vigorous against significant levels of commotion. An assessment convention is characterized so as to think about four unique attributes of the calculation: non-musical examples, various degrees of SNR, precise pinnacle location and various degrees of physical movement. This convention depends on the MIT/BIH arrhythmia database and extra ECG chronicles under various degrees of physical movement estimated by 2-hub accelerometers moreover, this technique was improved to work progressively, for future execution in a Wireless ECG sensor dependent on a chip [7]. Ruchika Gupta and BVR Reddy proposes a savvy strategy for following a human's versatility utilizing two advancements viz General Packet Radio Service (GPRS) and Global Positioning System (GPS). The entire framework enables the client's portability to be followed utilizing a cell phone which is furnished with an inside GPS collector and a GPRS transmitter [8]. Gavimath et al. describes the advancement of a programmed saline observing framework utilizing a minimal effort indigenously created sensor and GSM (Global framework for portable correspondence)

modem. This empowers the specialist or attendant on obligation to screen the saline stream rate from a separation. The yield from the flow rate sensor is prepared to check whether the stream rate is moderate, medium or quick and the equivalent is transmitted through GSM innovation to a far off versatile cell for future actions [9].

The main aim of this research paper is to delineate the utilization of a device which can play out the double capacity of identifying a coronary failure without the mediation of any authority for potential unfortunate casualty and furthermore inform the crisis administrations. Stroke can be handled on the off chance that it is identified and proper measures are taken in a split second. The research paper illustrates how a device called 'Kinect' can used to identify a respiratory failure and the indications experienced alongside it. A bit by bit manual for its working in an occasion of cardiovascular failure and the how the utilization of GSM framework and Skype highlight can be utilized for sending a ready sms to family members and crisis benefits As well as, gives video conferencing alternative specialist. Which is clarified in the paper .In all the most obvious opportunity for endurance of a patient who encounters a cardiovascular failure and fastest medicinal consideration can be guaranteed. Breathed out breath examination is a quickly extending region of research to ponder aviation route irritation and lung oxidative pressure, permitting the location of unstable and non-unpredictable substances from the aviation routes. The most concentrated unpredictable marker is breathed out nitric oxide (FENO), which is viewed as a decent marker of aviation route aggravation. Instigated sputum is a substantial and settled technique for breaking down both cell and biochemical markers of aviation route aggravation. In any case, this system isn't effectively performed in kids, and the inward breath of hypertonic saline arrangement may incite hacking, broncho choking, and a brief fiery reaction [10]. This home administration of asthma checking device exhibit that transient consistence with PEF observing is genuinely great. Notwithstanding, long haul

consistence with PEF estimations is poor, and long haul the board of asthma ought not depend on PEF gauges alone, however ought to incorporate instructive intercession, undeniably planned for improving patient acknowledgment of asthma side effects. Pinnacle stream meter use ought to presumably be held for those patients who show a huge enthusiasm for utilizing the gadget, poor perceivers of wind current deterrent, and seriously asthmatic subjects. In clinical preliminaries on asthma that incorporate PEF estimations as a significant result, the utilization of electronic pinnacle stream meters that store recorded information could help guarantee the legitimacy of the information [11]. A basic method which comprises in applying negative weight at the mouth during a tidal lapse (NEP), Patients in whom NEP inspires an expansion in stream all through the termination are not stream constrained. Conversely, patients in whom use of NEP doesn't evoke an expansion in stream during most or some portion of the tidal termination are considered as stream constrained. Utilizing this method, 26 stable COPD patients were considered sitting and recumbent. Eleven patients were stream restricted both situated and prostrate, eight were stream constrained just when recumbent, and seven were not stream restricted either situated or recumbent. Just 5 of 19 patients who were stream constrained situated as well as prostrate had extreme ventilator weakness (constrained expiratory volume in one second (FEV1) <40% anticipated). Consequently it infer that the NEP strategy gives a straightforward, fast, and dependable technique for location of expiratory stream constraint in unexpectedly breathing subjects, which doesn't require the patient's co-activity, and can be applied in various body positions both very still and during solid exercise. Therefore the outcomes likewise show a high commonness of stream confinement in COPD patients very still, especially when recumbent [12].

III. PROPOSED SYSTEM METHODOLOGY FOR HEART PATIENTS

The microcontroller (PIC16F877A) is the central unit of this system, It controls and co-ordinates all other components during operation. The system monitors the heart rate continuously by using a heart rate sensor, if there is any abnormality present the microcontroller triggers the defibrillation circuit in order to deliver a small amount of biphasic shock for making the heart rate normal. Using GPS and GSM interface immediate information of the patient can be send to the fixed numbers and thus maximum time delay can be avoided. In this work our aim is to provide a temporary aid to the critical patient to ave his/her life for a while. Immediate medical attention is required to save their life. Sensors are devices that are used to measure any change in physiological quantity. Heart rate sensor measures one's pulse progressively. The sensor is utilized to monitor the cardiac activity of the patient. The heart rate measured by the sensor is converted into electrical signals and these electrical signals are given to the microcontroller. The microcontroller verifies the sensor output and if there is any deviation from the pre determined threshold then the micro controller sends a signal to switch on the buzzer. The micro controller used is PIC16F877A. It is utilized in apparatus and control frameworks, for example, alerts, card perusers, continuous checking applications and considerably more. Ringer or beeper is a sound flagging device, which might be mechanical, electromechanical or piezoelectric. The typical uses include alarm devices, timers. If abnormality is detected buzzer get activated. Button switch is used to switch off the buzzer. This button can be used by the patient manually. The buzzer has a time delay of 10micro second if the buzzer is not switched off within this time limit then the microcontroller sends a sms to a fixed number using the GSM interface. GSM is a specialized type of modem that allows communication over the mobile network. The GPS installed in this system allows

locating the position of the patient. The geographical position and the cardiac parameters of the patient are sending to a fixed number using GPS and GSM. The shock that is to be delivered to the patient is already defined in the system. The micro controller decodes the amount of shock to be delivered and triggers the defibrillation circuit. Defibrillation circuit delivers appropriate shock to the patient and makes the heart rate normal. LCD display is used it displays the heart rate and the amount of shock delivered to the patient.

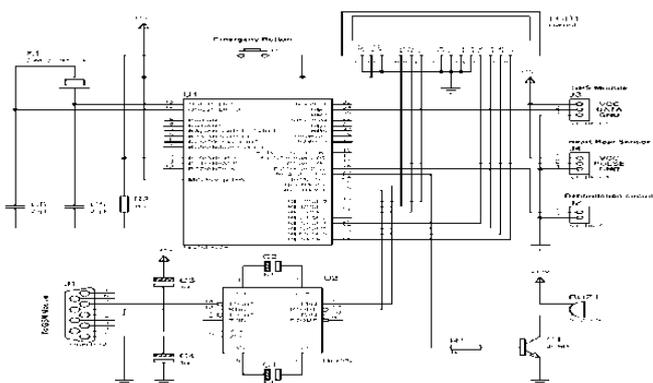


Fig.1 Circuit diagram for the proposed system

Fig.1 shows the connecting of different segments together, RS-232 is a standard correspondence convention for connecting PC and its peripheral devices to permit sequential information trade. In straightforward terms RS232 characterizes the voltage for the way utilized for information trade between the devices. It determines basic voltage and sign level, basic stick wire design and least, measure of control signals. As referenced over this standard was structured with determination for electromechanically teletypewriter and modem framework and didn't characterize components, for example, character encoding, confining of characters, blunder discovery conventions and so forth that are basic highlights when information move happens between a PC and a printer. Without which it couldn't be received to move information between a PC and a printer. To beat this issue a solitary coordinated circuit called as UART known as widespread nonconcurrent collector/transmitter is utilized related to RS232.

The MAX232 IC is utilized to change over the TTL/CMOS logic levels to RS232 logic levels during sequential correspondence of microcontrollers with PC. The controller works at TTL logic levels (0-5V) though the sequential correspondence in PC takes a shot at RS232 standards (- 25 V to + 25V). This makes it hard to set up an immediate connection between them to speak with one another.

IV. PROPOSED SYSTEM METHODOLOGY FOR ASTHMATIC PATIENTS

Portable external monitoring device which collects multiple information's from patient safer two breath maneuvers. When air is blow through airflow detector the sensors present in this device automatically sense and gives the digital result in display. Telemetric system is capable to deliver the information to the physician for further treatment by ZIGBEE technology. In existing system classic spirometry and peak flow detectors are used but the output is a graphical representation to observe by the physician more complex. So, we develop the digital output by a LCD. Telemetric capacities help doctors to get asthma side effects and lung work after some time. This monitoring device consists of heart rate sensor, pressure sensor, chemical sensor which display in LCD.

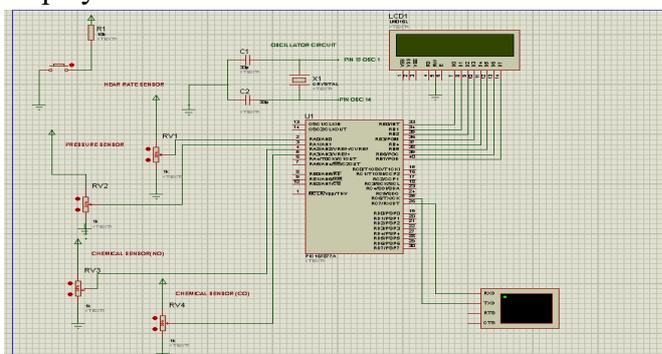


Fig.2 Circuit Connections

Fig.2 shows the total circuit connection of the proposed work. This work deals with providing an effective lung function monitoring system which consists of chemical sensors, pressure sensor and

heart rate sensor to detect the respiratory functions. The sensors detect the signals and transfer it to the microcontroller as an electrical energy and convert it into the digital output in LCD display. By using ZIGBEE it sends the information to the physician. The power supply is given to the receiver side and it transfers the data to the computer of a physician used to control the disease.

V. RESULT AND DISCUSSIONS

The device will recognize heartbeat of individual persistently in given premises. On the off chance that any abrupt vacillation in heartbeat underneath some level is identified, at that point the framework will begin working. The system monitors the heart rate continuously by using a heart rate sensor, if there is any abnormality present the microcontroller triggers the defibrillation circuit in order to deliver a small amount of biphasic shock for making the heart rate normal. The buzzer gets activated and during fluctuation in heart beat it alerts the surrounding area by providing an alarm. Button switch helps to reduce false alarm. Using GPS and GSM interface immediate information of the patient can be sent to the fixed numbers and thus maximum time delay can be avoided.

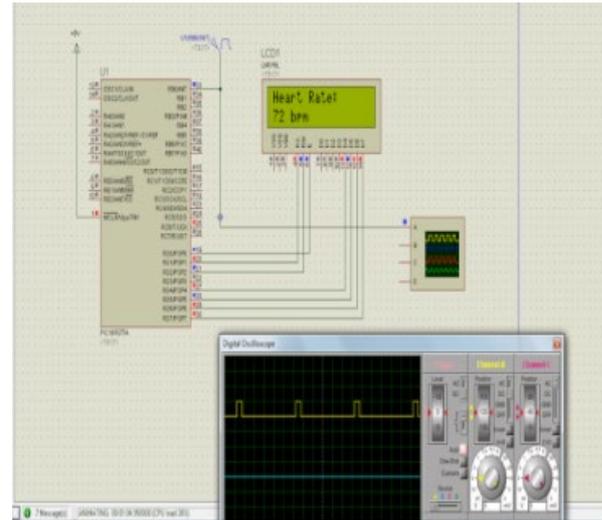
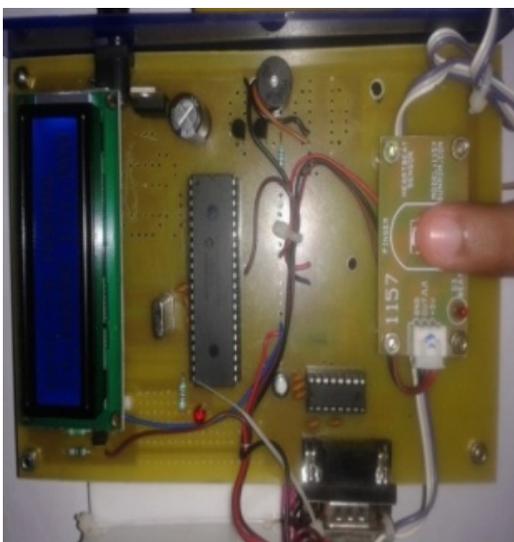


Fig.3 Designed proposed system with LCD Displays

The image above shows (Fig.3) the designed proposed system where the input is given by means of placing finger tip on the heart rate sensor; once the input is given the alphanumeric LCD displays the heart rate of the patient. If there is any fluctuation in the heart rate the system delivers appropriate shock to the patient by means of paddles which is already attached to the sternum and apex of the patient and mean time the current heart rate furthermore, area of the patient is sent to predefined numbers with the help of GPS and GSM. The software output obtained is also shown there.

- A question may surely arise that, does every one want to carry those paddles and the entire system every time to protect them from myocardial infraction?

The answer is quite simple that, the system we designed is meant only for those patients who have fortunately survived from one heart attack and expecting future silent attacks due to their unsatisfied health conditions. In such scenario the system can be suggested to them for ensuring their family members to provide proper care and attention for them. The paddle gets attached to them and a pocket size device which is easy to carry is provided. By implementing this system they are safe to go anywhere in the given premises without the fear of unexpected cardiac arrhythmias. This system provides only a temporary medical aid to those patients who are vulnerable to unpredictable cardiac

disorders at any time. ie, it is designed to shorten the time period between snapshot of heart brokenness and the appearance of therapeutic staff.

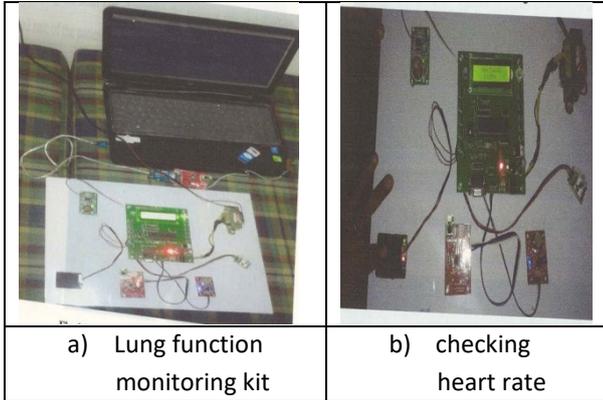


Fig. 4 Function monitoring, checking and displaying hardware devices



Fig. 5 Normal breath rate

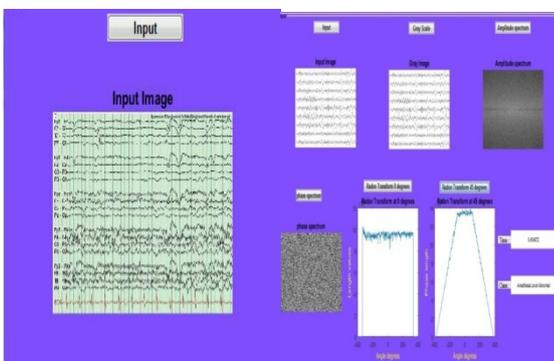


Figure 6 Input and Output image of monitoring

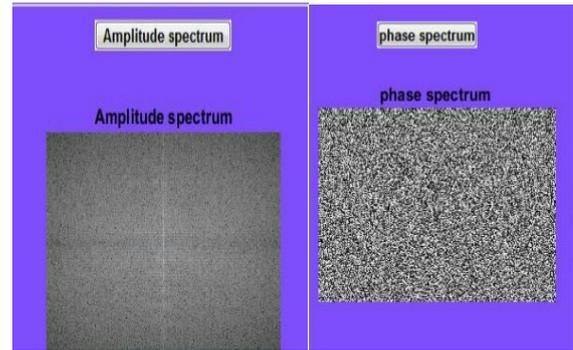


Figure 7 Amplitude and Phase spectrum of monitoring

In this work, a sensor to recognize and screen the seriousness of asthma was effectively made by the past analyst to upgrade the proficiency of the apparatus. Fig. 4 shows the Lung function monitoring, checking and displaying devices. Fig.5 shows the normal breath rate. Fig. 6 and Fig. 7 shows the Input, Output, Amplitude and Phase Spectrum of monitoring. Modernize investigation to doctor may broaden the utilization in restorative territories and advance the utilization to screen asthmatic patient during asthmatic assault. With further research, may fill in as another technique in checking asthma as it has extraordinary potential because of its properties of non-obtrusive, exertion free, and persistent observing. Likewise, in future, examination of asthmatic patient utilizing the peak flow meter and spirometer will be incorporated with the goal that a total observing instrument can be created to screen seriousness of asthma it also detect the harmful gases by using the sensors CO, CO₂,NO.

VI. CONCLUSION

This work is aimed to function the system as an immediate first aid to those peoples who are vulnerable to cardiac disorders at any time. It is meant for shortening the time period between snapshot of heart dysfunction and the appearance of therapeutic personnel. The defibrillator unit provides required amount of shock to the patient in order to bring back the normal rhythm. The resulting found to be very good and efficient in real time. This work

practically proven that such devices are good for saving the life of humans up to an extent. Thus we concluded that our paper 'Emergency reporting device for Heart patients using wearable defibrillator with GPS &GSM interface', presents an ongoing remote system framework for checking and identifying any up and coming heart disease by utilizing sensor. Also this work is aimed towards the welfare of asthmatic patients. Now days, lot of machines was discovered to monitor the asthmatic condition, but no one can give the accurate result. This work represents a major importance to the asthmatic patient through its monitoring feature and the telemetry capability. So, that it was great advanced one in medical field.

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