Portable Patient Care Monitoring Solution

A GRADUATION PROJECT SUBMITTED TO THE

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Chapter1: Introduction

Getting old is an inevitable part of life. As we get old our body becomes weaker until it expires approximately at the ages of 80for women & 84 for men. As human's body age some symptoms appear longed with some diseases that can happen as effect of weakness & metabolism , for example greying and thinning hair, loss of fertility, weakening bones, decreased brain function and losing the ability to hear and focus their eyes ,heart diseases, breathing difficulty, reduction in total body water which causes a decrease in blood volume, slow heart rate due to fibrous tissues and fat deposits that causes the SA node to lose some of its cells, thickness in the heart wall which leads to a decrease in the amount of blood that the chamber can hold and causes the heart to fill slowly, abnormal heartrhythms, the valves inside the heart which control the direction of blood flow thicken and become stiffer, moderate increase in blood pressure, decrease in body water which cause a decrease in blood volume & slower response to blood loss. Our project introduces a portable solution in order to monitor vital parameters of the human body as pulse rate, temperature & respiratory rate. This will allow the individual to live independently & engage in his daily activities

Chapter 2:Literature

2.1 Cardiovascular changes with Physiologic Aging vs. Disease.

Cardiac function is altered in an age-related manner and cardiovascular diseases increase with increasing age.

❖ 2.1.1 Aim

1) to identify cardiac changes which are characteristic of physiologic aging (i.e., not disease),
2) highlight the altered presentation and modifications of therapy for older patients with common cardiovascular diseases such as hypertension, atrial arrhythmias, and coronary artery disease, and
3) identify cardiovascular diseases and treatments which are unique to older populations.

❖ 2.1.2 Normal Rhythm

2.1.2.1 Heart Rate

Resting heart rate is not generally affected by aging however, there is decreased heart rate in response to exercise and stress which is characteristic of healthy aging. The clinical consequence of this is that maximal heart rate on treadmill is decreased (220-age) and the heart rate response to fever, hypovolemia, and postural stress is also decreased with healthy aging. The response to beta-adrenergic blockade (as well as stimulation) is also reduced with healthy aging. Day time bradycardia with heart rates < 40 bpm and sinus pauses of over 3 seconds are not seen with healthy aging.

2.1.2.2 Artrioventriculer Conductions

The time for conduction through the atrioventricular (AV) node is increased with healthy aging. Therefore, the P-R interval on the ECG increases with age and the upper limit of normal for people >65 is 210-220 milliseconds (not 200 ms). Second and third degree AV block are not normal consequences of aging. Right bundle branch block is seen more frequently in older compared to younger populations but has not been shown to identify increased risk for further conduction abnormalities. A gradual leftward shift of the QRS axis is observed with aging and left anterior hemiblock is seen with increasing frequency in older populations. Isolated left anterior hemiblock is not an independent predictor of cardiovascular morbidity or mortality in otherwise healthy elderly. Combined right bundle branch block and left anterior fascicular block is associated with cardiovascular disease in 75% of older patients and only 25% with this finding have otherwise normal hearts. Left bundle branch block is not associated with normal aging and is associated with cardiovascular disease and risks for cardiac events.

2.1.2.3 Arryhythmias

Atrial premature contractions increase with age and are frequent in up to 95% of older healthy volunteers at rest and during exercise in the absence of detectable cardiac disease. Atrial fibrillation is usually associated with coronary, hypertensive, valvular, sinus node disease or thyrotoxicosis but may occur in older patients with no other detectable diseases (1/5 of older men and 1/20 of older women with atrial fibrillation). Similarly, isolated and even multiform ventricular ectopy has been reported in up to 80 % of older men and women without detectable cardiac disease.

- **2.1.3 Cardiac contractility / left ventricular function at rest and during exercise**

In contrast to the decline in skeletal muscle mass seen with aging in healthy populations, left ventricular mass is preserved or increased with age.

2.1.3.1 Systolic Function

Resting left ventricular systolic function (ejection fraction and/or stroke volume) is not altered by aging in most studies of subjects rigorously screened to exclude coronary artery disease; however, a few studies report declines of stroke volume with sedentary older populations. Cardiac output is equal to stroke volume x heart rate. So, resting cardiac output and left ventricular ejection fraction do not usually decrease with normal aging. Contractile responses to beta-adrenergic responses are decreased with aging. Therefore, exercise cardiac output may be reduced due to both the decrease in maximal heart rate and a limit to the ability to increase contractility (stroke volume) in response to beta-adrenergic blockade in the elderly. The age-associated decline in maximal cardiac output and cardiovascular reserve capacity may not limit usual ability in otherwise healthy elderly because the vast majority of daily activities are performed at low and sub maximal workloads. In addition, the age-related decline in exercise capacity can be attenuated by physical conditioning.

2.1.3.2 Diastolic Function

The time for cardiac relaxation and for ventricular filling are prolonged with aging leading to altered early diastolic filling times on echocardiography and nuclear studies. The aetiology of the prolonged time for relaxation may be multi-factorial-increased ventricular mass, collagen infiltration, or altered myocardial calcium handling. Prolonged filling times may limit cardiac output with increased heart rates. While altered diastolic function accompanies aging, congestive heart failure is not a normal consequence of the prolonged times required for cardiac relaxation or diastolic filling.

2.1.3.3 Valvular Changes

Degenerative calcification (leading to sclerosis) and myxomatous degeneration (which can lead to regurgitation) affect the aortic and mitral valves with aging. These changes are considered "secondary" to aging and differ from the primary changes due to rheumatic heart disease or congenital valve abnormalities. These changes can progress to impair the function of the valve; then the changes are considered pathologic and no longer "normal aging".

Table 1 :Age-Related changes vs cardiovascular disease

Age-Related Changes	Cardiovascular Disease
Decreased Heart Rate Response	Sinus Pauses
Longer P-R Intervals	Second and Third Degree AV Block
Right Bundle Branch Block	Left Bundle Branch Block
Increased Atrial Ectopy	Atrial Fibrillation
Increased Ventricular Ectopy	Sustained Ventricular Tachycardia
Altered Diastolic Function	Decreased Systolic Function (Ejection Fraction)
Aortic Sclerosis	Aortic Stenosis, Aortic Regurgitation
Annular Mitral Calcification	Mitral Regurgitation, Stenosis Systolic Hypertension Diastolic Hypertension

❖ 2.1.4 Common Cardiovascular Diseases & Management in geriatrics

2.1.4.1 Arterial Fibrillation

The prevalence of chronic atrial fibrillation rises from <1 per 1000 people at 25-35 years of age to about 40 per 100 at ages 80-90 (Framingham data, Baltimore Longitudinal Study, Cardiovascular Health Study). Chronic atrial fibrillation has been shown to be an important risk factor for cerebrovascular accidents (strokes) and control of rate is associated with better exercise tolerance. The goals of therapy in an individual patient may vary and include rate control, prevention of stroke, or restoration of sinus rhythm.

2.1.4.2 Rate control

Immediate or long-term rate control can be achieved with the use of digoxin, beta-blockers, calcium antagonists (verapamil or diltiazem), or amiodarone in refractory cases. There is less experience with the use of new Class III agents (ibutelide). The adequacy of rate control must be assessed with activity--more active patients are less likely to have adequate rate control with digoxin alone. Drug doses should be adjusted for age and disease state and one must remember that adequate rate control may be lost during acute illnesses such as pneumonia, but will be regained with treatment of the acute illness.

2.1.4.3 Prevention of stroke

With acceptable risk benefit ratios can be achieved with anticoagulation with coumadin. However, the optimal therapy to prevent stroke for the older patient with atrial fibrillation has not been found. This author favours anticoagulation with coumadin to a target INR of 2-2.5 with close monitoring in elderly patients without contraindications to anticoagulation, esp. in patients with additional risk factors for stroke (hypertension, vascular disease, prior CVA). Aspirin alone is not a reasonable choice in the latter group.

2.1.4.4 Restoration of sinus rhythm

Should be considered in patients with abnormal cardiovascular function (esp. in the setting of aortic stenosis or hypertrophic cardiomyopathy), atrial fibrillation which is not of long-standing, or is difficult to control. This goal is more frequently sought in younger patients.

Anticoagulation must be instituted prior to cardioversion and continue during the period of highest risk for fibrillation recurrence. Analyses of risk of recurrence based on age alone have not been performed.

2.1.4.5 Hypertension

The prevalence of hypertension--especially systolic-- increases with aging. This increase in systolic pressure is thought to be due to thickening of the arterial wall which makes it less distensible and less able to buffer the rise in pressure that occurs with cardiac ejection. These changes result in an elevated systolic blood pressure with a relatively unchanged diastolic blood pressure. A large body of data have now demonstrated that cardiovascular morbidity and mortality increase with increasing systolic as well as diastolic blood pressure in the elderly. Furthermore, treatment of both diastolic and isolated systolic hypertension has been shown to decrease mortality and morbidity in both older men and women--there is a decrease in adverse events for every degree of blood pressure reduction toward the normal range. Treatment goals are now the same for older patients as they are for younger patients---systolic blood pressure < 140 mmHg and diastolic pressure < 90 mmHg.

Treatment begins with diet (weight reduction if obese; low sodium for all, and < 1 oz of alcohol/day) and exercise. The long-term benefits of antihypertensive therapy in the elderly have been demonstrated for thiazide diuretics (chlorthalidone 12.5-25 mg/day, hydrochlorothiazide 25 mg/day) alone or in combination with beta-blockers (atenolol 50 mg/day, metoprolol 50 mg/day). Thiazide diuretics and/or beta blockers are recommended as first-line pharmacologic therapy for the older patient with hypertension (and no other diseases) because of demonstrated longevity benefit and lower cost. Alpha-methyl-dopamine and reserpine have also shown mortality benefits but are less widely used secondary to side effects. Calcium channel blockers, angiotensin converting enzyme (ACE) inhibitors, alpha-blockers, and angiotensinogen II inhibitors are highly effective in lowering blood pressure in older patients and may have advantages in hypertensive patients with multiple diseases (i.e., calcium channel blockers for coronary artery disease, cerebrovascular disease, diabetes, chronic obstructive pulmonary disease, diabetes with renal disease; ACE inhibitor for congestive heart failure, diabetic with renal failure, etc.; alpha blocker for prostate disease). Similarly, beta-blockers have an advantage in the post-myocardial infarction patient. No adverse effects on quality of life or mood have been demonstrated with the use of beta-blockers in the elderly in randomized clinical trials. All drug dosages should be adjusted for age and disease-related changes.

2.1.4.6 Coronary artery disease

It has long been recognized that the prevalence of coronary artery disease rises with increasing age and that multi-vessel disease in older patients with coronary artery disease is more common. The age-related increase in coronary artery disease occurs in women as well as men but begins at a later age in women. The same risk factors that predict atherosclerosis in younger adults (lipid abnormalities, smoking, hypertension, diabetes) are predictive in older individuals as well. Modification of these risk factors is effective in reducing the risk of atherosclerosis in older patients. Therefore, preventive strategies for the older patient include stopping smoking, blood pressure control, control of lipid abnormalities, and treatment of diabetes.

The approach to diagnosis in the elderly is similar to that in the younger patient. The history may be somewhat more difficult to interpret because exercise may be limited by other factors (arthritis, pulmonary disease, etc.) and chest discomfort may be atypical because of the prevalence of diabetes (10% of the elderly) and the greater preponderance of women in the older populations. ECG criteria for the diagnosis of coronary artery disease are also not as reliable in women of any age as in men. Nuclear imaging (usually thallium) with or without pharmacologic stress is often used to overcome the limits of ECG interpretation, but again is not as good in women as men (estimated 20% false positives). Because the prevalence of coronary artery disease is high in the elderly, the goal of diagnostic testing may be to quantify the amount of ischemia rather than to diagnose its presence and perfusion imaging allows localization, quantification, and differentiation between infarcted and ischemic myocardium. Pharmacologic stress testing combined with echocardiography may also have some advantages in the older patient since it can provide assessment of valvular function, left ventricular function, and the presence and extent of wall motion abnormalities indicative of ischemia or infarction. Angiography is of value for both assessment and as a prelude to interventions. Slightly greater complications are seen in older patients than in younger patients (local bleeding, stroke) but remain low. This should be recognized but should not preclude procedures.

Treatment considerations for coronary artery disease in the older patient do not differ from those in the younger patient with coronary artery disease with the exception of the elderly diabetic patient with coronary artery disease (see below). The therapeutic choices include medications (nitrates, beta-blockers, calcium blockers), lipid lowering regimens (effective in older patients as well as young) and revascularization procedures. Note that resting heart rates should not be used as an indication of beta blockade or as a contraindication of beta blockade. Revascularization procedures (angioplasty or surgery) may be of greater benefit than pharmacologic therapy in patients with multi-vessel disease and decreased left ventricular function. In the elderly diabetic with multi-vessel disease, surgical intervention has a more favourable outcome than angioplasty. Complication rates for angioplasty and surgery are slightly higher in the older patient but still relatively low. It has been noted that fewer women than men have been treated with angioplasty or surgery and that women undergoing such procedures have more advanced disease. This finding could represent atypical presentation or failure of the medical community to recognize the prevalence of coronary artery disease in older women. Another current issue is the possible decrease in cognitive function in older patients undergoing coronary artery bypass graft procedures.

2.1.4.7 Myocardial infraction

The older patient with myocardial infarction also benefits from the same therapies as the younger patient and age >75 alone should not be a contraindication to thrombolytic therapy. Beta blockers and aspirin should be administered post-infarction. ACE inhibitors are also of probable benefit if given in lower doses and not during the immediate acute MI period. However, goals of the post-MI period may differ for the older patient vs. the younger patient. All physiologic processes related to healing and stress appear to be attenuated with aging, so timing for diagnostic testing after the acute event may need to be slightly later in older patients. In addition, the probability of post-MI ischemia is greater in the older patient because of the higher incidence of multi-vessel disease. No studies of predominantly older patients have been performed to identify the best post-MI strategy for further risk stratification and to guide in clinical decision making regarding medical vs. revascularization strategies. Therapy should therefore be individualized and it is not appropriate to consider the older patient, esp. in the presence of multiple diseases, as a "routine" post-MI pathway patient.

2.1.4.8 Congestive heart failure

- Systolic

The therapy of congestive heart failure due to systolic dysfunction does not differ in the older patient. The mainstays of therapy are digoxin, diuretics, and esp. angiotensin converting enzyme inhibitor drugs. Renal function and potassium may need to be monitored more closely in the older patient because of the likely concomitant administration or ingestion of nonsteroidal anti-inflammatory drugs (high incidence of arthritis in the older population) and the additive effects of NSAID's to lower renal perfusion and potassium excretion. The role of beta blockers in the management of patients with congestive heart failure is just emerging and there are no data regarding the older patient.

- Diastolic

Congestive heart failure with preserved left ventricular systolic function is termed "diastolic heart failure" and is more prevalent in the older population, may account for one half of the older population with congestive heart failure, and may be more common in women than men. The prognosis of patients with CHF due to diastolic dysfunction is less ominous than in patients with systolic dysfunction yet the morbidity can be high with frequent treatment failures and hospital readmissions. No long-term studies of drug therapies for diastolic congestive heart failure have been performed. Drugs which selectively affect diastolic filling and relaxation (calcium channel antagonists or beta-adrenergic blockers) can alter these parameters after short-term administration and might provide a specific therapy. However, one of the more surprising findings from a recent trial was the lower incidence of recurrent hospitalizations and death in patients with congestive heart failure who received digoxin (vs. placebo) in combination with diuretics and ACE inhibitors. This was true for CHF patients with both decreased and preserved systolic function. Thus, optimal management of the older patient with diastolic congestive heart failure is evolving. Control of hypertension, prevention of myocardial ischemia, treatment of congestive heart failure symptoms, and maintenance of normal sinus rhythm have received emphasis. It appears that digoxin and diuretics do play a role and that beta blockers and/or calcium blockers may also play a role. Treatment of acute exacerbation of congestive heart failure or pulmonary edema in the setting of diastolic heart failure focuses on diuretics and, if needed, positive inotropes on a short-term basis. The role of ACE inhibitors is unclear unless used for the treatment of hypertension or to attempt regression of hypertrophy.

- Multidisciplinary team approach

The concept of a team approach for the care of the patient with congestive heart failure is rapidly gaining favour. The team compositions vary but usually consist of physicians and nurses and other health professionals (dieticians, social workers, physical therapists, or exercise technicians) who focus not only on medication prescribing but patient and family dietary education, close follow-up of weight and symptoms of patients in the home (phone or home care), with a goal of improving CHF and preventing hospitalizations. In a recently completed trial of older patients with congestive heart failure, the team care patients had fewer hospitalizations, improved perceived quality of life, and lower medical costs for up to one year after randomization, compared to the conventional care group. These data suggest that the geriatric multidisciplinary team approach is beneficial for cardiac diseases in the older patient.

2.1.4.9 Valvular disease

- Aortic Stenosis

The frequency of aortic stenosis increases with age and it is the most clinically significant valvular lesion in the elderly. Progressive degenerative calcification is now the most common cause, as opposed to rheumatic disease. The calcification occurs along the margins of the valve leaflet (vs. commissural fusion in rheumatic fever) and thus does not affect valve opening or closing during the early stages but will produce a murmur. Because of the stiffened peripheral arteries in the older patient, the carotid pulse may feel normal to palpation even in the presence of significant aortic stenosis. Other physical findings associated with critical aortic stenosis due to rheumatic heart disease are often absent with calcific aortic stenosis (decreased S1 and S2). The intensity of the murmur does not correlate with the severity of stenosis. Progression to critical aortic stenosis is often gradual but is unpredictable. Therefore, diagnostic testing is essential for the diagnosis or evaluation of a symptomatic elderly patient with an aortic systolic murmur. Fortunately, non-invasive echocardiographic and Doppler testing can now accurately assess the severity of obstruction as well as define the aortic valve. About 20% of elderly patients with aortic disease have a rheumatic etiology--these patients usually have associated mitral valve disease and should receive antibiotic prophylaxis before all invasive procedures including dental procedures. The only effective treatment for critical aortic stenosis is surgical. Aortic valve replacement, even in older patients, improves survival and quality of life. Experience with aortic balloon valvuloplasty shows that re-stenosis occurs frequently within months and it has thus been largely abandoned.

- <u>Aortic Regurgitation</u>

The most common cause of aortic regurgitation in the elderly is aortic root dilation secondary to the age-related rise in blood pressure and increased peripheral resistance. With the advent of widespread echocardiography, mild degrees of aortic regurgitation are diagnosed frequently and are usually not of clinical significance. Aortic regurgitation due to rheumatic valvular disease or associated with disease of a bicuspid valve is more likely to progress to clinically significant disease. When significant aortic regurgitation is present, therapy is aimed at afterload reduction and clinical symptom relief with monitoring for definitive surgical intervention prior to left ventricular failure.

- <u>Mitral valve disease</u>

Mitral regurgitation accounts for 2/3 of mitral valve disease in the elderly. The etiologies include rheumatic disease (usually with concomitant aortic disease), papillary muscle dysfunction due to ischemia or infarction, calcification of the mitral annulus (more common in women than men), and myxomatous degeneration causing mitral valve prolapse. Medical management centers on maintenance of sinus rhythm or control of atrial fibrillation, afterload reduction and prevention of infection by use of prophylactic antibiotic regimens before all invasive procedures (including dental). The subset of patients with significant mitral regurgitation and mitral valve prolapse may have an increased risk for stroke and should be considered for anticoagulation. Acute symptoms may also benefit from diuretics. As disease progresses, the ventricle dilates and pulmonary hypertension develops and medical treatment is no longer effective. Surgical interventions have the best results prior to the development of ventricular dysfunction or marked dilation. Operative results to date show return toward normal pressures and ventricular size, but improvement is not as marked as that seen after aortic valve replacement. Therefore, optimal surgical timing has not been identified but morbidity and mortality are high once left ventricular failure occurs. Surgical repair as opposed to replacement is currently being used and evaluated for patients with regurgitation and noncalcified, nonstenotic valves. This may preclude the need for anticoagulation with mechanical valves, which could potentially be of clinical advantage in the older patient since surgical mitral valve replacement (whether it is a tissue or mechanical valve) requires lifelong high intensity anticoagulation. The management of the less common mitral stenosis in the elderly also targets control of heart rate and symptoms (digoxin and diuretics), anticoagulation to prevent emboli, and antibiotic prophylaxis to prevent infections. Surgical therapy is the only definitive therapy. Valvuloplasty is seldom of long-term benefit.

❖ 2.1.5 Summary

It is important to differentiate the cardiac manifestations of normal aging which do not require medical management from cardiac disease in the older patient. A rationale for greater utilization of diagnostic techniques can be made in the older patient who may present with atypical symptoms, multiple confounding medical problems, and age-related alterations in physical findings of some cardiac diseases. The management of most cardiac diseases in the older patient is similar to that of the younger patient, with the important recognition of the need to reduce medication dosages and be aware of the increased risk of adverse effects or drug interactions. Age should not be a contraindication to invasive procedures or surgical procedures or thrombolytic therapy, since when properly selected, they benefit older patients to the same or greater degree as younger patients. For several diseases unique to aging (i.e., diastolic heart failure or atrial fibrillation), optimal therapeutic strategies are still evolving.

Table2. Unique Features of Cardiovascular Disease in the Elderly

	Presentation	Diagnosis	Treatment
Acute M.I.	Shortness of breath, CHF Chest discomfort, nausea or vomiting, acute confusion	ECG, serum markers or imaging	Thrombolysis ?Revascularization
Atrial Fibrillation	Shortness of breath, CHF rate slower than in young (so may appear regular)	Apical pulse, ECG	Rate control, anticoagulation
Coronary Artery Disease	Chest discomfort or shortness of breath with emotion or exertion, women as well as men	Exercise Test Nuclear stress imaging Stress Echo Smoking cessation Medicine Angioplasty Coronary Bypass Lipid reduction	
Congestive Heart Failure	Same as young	Diastolic > systolic	Diuretics Digoxin + beta-blockers or CaH blockers (diastolic)
Hypertension	Systolic, asymptomatic	Three readings at > 2 weeks apart	Diet, exercise Alcohol withdrawl Medications
Valvular Disease	Altered physical findings	Echocardiography	Critical--surgery

2.2 Respiratory systems in geriatric patients

The effects of aging on the respiratory system are similar to those that occur in other organs maximum function gradually declines. Age-related changes in the lungs include

- Decreases in peak airflow and gas exchange
- Decreases in measures of lung function such as vital capacity (the maximum amount of air that can be breathed out following a maximum inhalation)
- Weakening of the respiratory muscles
- Decline in the effectiveness of lung defense mechanisms

In healthy people, these age-related changes seldom lead to symptoms. These changes contribute somewhat to an older person's reduced ability to do vigorous exercise, especially intense aerobic exercise, such as running, biking, and mountain climbing. However, age-related decreases in heart function may be a more important cause of such limitations.

Older people are at higher risk of developing pneumonia after bacterial or viral infections. Thus, vaccines for respiratory infections such as influenza and pneumococcal pneumonia are particularly important for older people.

Importantly, age-related changes in the lungs compound the effects of heart and lung diseases the person may have, especially those caused by the destructive effects of smoking.

2.3 Homeostasis in geriatric patients

Management of abnormalities in water homeostasis is frequently challenging because age-related changes and chronic diseases are often associated with impairment of water metabolism in elderly patients, it is absolutely important for medical practitioners to be aware of the pathophysiology of hyponatremia and hypernatremia in the elderly. The sensation of thirst, renal function, concentrating abilities and hormonal modulators of salt and water balance are often impaired in the elderly, which makes such patients highly susceptible to morbid and iatrogenic events involving water and salt.

The aging process is frequently accompanied by various maladaptations to stress in different organ systems and physiologic functions. The complex mechanisms associated with water metabolism are particularly vulnerable to age related maladaptations and to the various disease processes and medical interventions that frequently occur in the elderly.

The status of water homeostasis in the body is efficiently reflected by the serum sodium concentration. Sodium is the dominant cation in extracellular fluid and the primary determinant of serum osmolality. If a change in the total body water concentration occurs without an accompanying change in total body solute, osmolality changes along with the serum sodium concentration.

Chapter 3: What are vital parameters?

Vital parameters, or vitals, are a group of the 4 to 6 most important signs that indicate the status of the body's vital (life-sustaining) functions. These measurements are taken to help assess the general physical health of a person, give clues to possible diseases, and show progress toward recovery. The normal ranges for a person's vital signs vary with age, weight, gender, and overall health.

There are four primary vital signs: body temperature, blood pressure, pulse (heart rate), and breathing rate (respiratory rate).

Monitoring of vital parameters most commonly include at least blood pressure and heart rate, and preferably also pulse oximetry and respiratory rate. Multimodal monitors that simultaneously measure and display the relevant vital parameters are commonly integrated into the bedside monitors in critical care units, and the anesthetic machines in operating rooms. These allow for continuous monitoring of a patient, with medical staff being continuously informed of the changes in general condition of a patient.

While monitoring has traditionally been done by nurses and doctors, a number of companies are developing devices which can be used by consumers themselves. These include Scanadu and Azoi.

Azoi is a company that makes medical devices for consumers. The company was founded in 2011. It is based in San Francisco. A prototype of Azoi's first product, Wello, was unveiled when the company launched on March 6, 2014. Based in Sunnyvale, California, Scanadu is a consumer medical technology company developing next generation tests, devices, and services that empower individuals to monitor and better understand their own health – anytime, anywhere. Below is a figure showing their product which shows the results on the mobile phone via bluetooth. This device will be placed on the forehead & held using the fingers just like in the figure.

Figure 1: Scandu Scout 3D FilaPrint

Chapter 4: Software

4.1 Wi-Fi microchip

The **ESP8266** is a low-cost Wi-Fi microchip with full TCP/IP stack and micro controllercapability produced by Shanghai-based Chinese manufacturer, Espressif Systems.

Table 3:

Manufacturer	Espressif Systems
Type	32-bit microcontroller
CPU	@ 80 MHz (default) or 160 MHz
Memory	32 KiB instruction, 80 KiB user data
Input	16 GPIO pins

This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.
The **ESP8285** is an ESP8266 with 1 MiB o8f built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.
The successor to these microcontroller chips is the ESP32.

4.1.1 Features

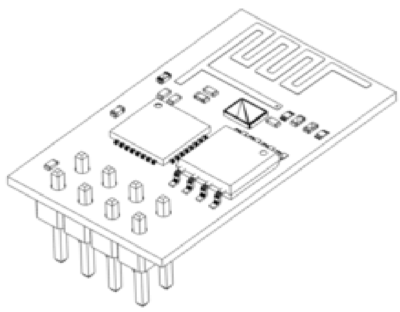

figure 2:ESP-01 wireframe.

- Processor: L106 32-bit RISCmicroprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz†
- Memory:

1- 32 KiB instruction RAM

2- 32 KiB instruction cache RAM

3- 80 KiB user data RAM

4- 16 KiB ETS system data RAM

- External QSPI flash: up to 16 MiB is supported (512 KiB to 4 MiB typically included)

- IEEE 802.11 b/g/n Wi-Fi

1. Integrated TR switch, balun, LNA, power amplifier and matching network
2. WEP or WPA/WPA2 authentication, or open networks

- 16 GPIO pins
- SPI
- I²C (software implementation)
- I²S interfaces with DMA (sharing pins with GPIO)
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2
- 10-bit ADC (successive approximation ADC)

† Both the CPU and flash clock speeds can be doubled by overclocking on some devices. CPU can be run at 160 MHz and flash can be sped up from 40 MHz to 80 MHz.Success varies chip to chip

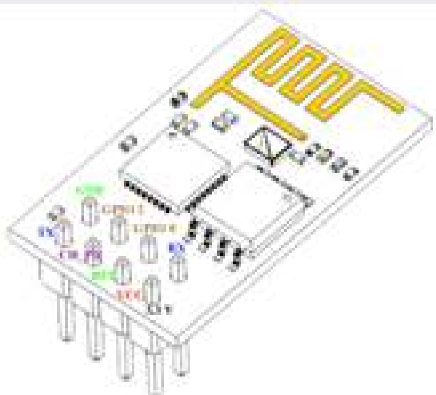

Figure 3: ESP v-1 pinout

The Pinout is as follows for the 1st basic module,

- VCC, Voltage (+ 3.3 V (it can handle up to 3.6v))

- GND, Ground (0 V)

- RX, Receive data bit X

- TX, Transmit data bit X
- CH_PD, Chip Power Down
- RST, Reset
- GPIO 0, General Purpose Input-Output No. 0
- GPIO 2, General Purpose Input-Output No. 2

4.1.2 Procedure

The Wi-Fi chip allows us to send the results obtained from the device to a mobile phone so as to alert the patient of the problem. In order to this the chip sends the information to a server where it is translated to a language a human can understand (from analogue to digital). The server sends the information to a mobile application on the patients phone. There it will give the patient an alert allowing them to check the given information and take necessary action. The application can also be accessed by the paramedics such that they can get to the patient without the patient contacting them in cases of fatal conditions. The patient can also check the information on the application even when no alert given.

The advantage of using the Wi-Fi chip is that the device will not require any external Wi-Fi to work such that it will be active at all given times.

4.2 raseberry pi:

The raspberry pi comes in two models, they are model A and model B. The main difference between model A and model B is USB port. Model A board will consume less power and that does not include an Ethernet port. But, the model B board includes an Ethernet port and designed in china. The raspberry pi comes with a set of open source technologies, i.e. communication and multimedia web technologies.In the year 2014, the foundation of the raspberry pi board launched the computer module, that packages a model B raspberry pi board into module for use as a part of embedded systems, to encourage their use.

4.2.1 Raspberry Pi Hardware Specifications

The raspberry pi board comprises:

- a program memory (RAM)
- processor and
- graphics chip
- CPU
- GPU

- Ethernet port
- GPIO pins
- Xbee socket
- UART
- power source connector
- various interfaces for other external devices
- It also requires mass storage, for that we use an SD flash memory card. So that raspberry pi board will boot from this SD card similarly as a PC boots up into windows from its hard disk.

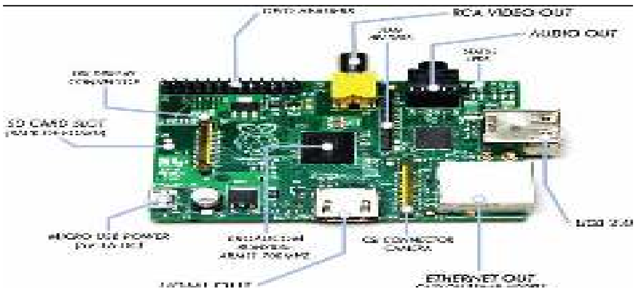

Figure5: raspberry model

4.2.2 Features of Raspberry PI Model A

- The Model A raspberry pi features mainly includes
- 256 MB SDRAM memory
- Single 2.0 USB connector
- Dual Core Video Core IV Multimedia coprocessor
- HDMI (rev 1.3 & 1.4) Composite RCA (PAL and NTSC) Video Out
- 3.5 MM Jack, HDMI, Audio Out
- SD, MMC, SDIO Card slot on board storage
- Linux Operating system
- Broadcom BCM2835 SoC full HD multimedia processor
- 8.6cm*5.4cm*1.5cm dimension

Chapter 5: Materials and Methods

5.1 The aim of the project:

To provide a portable vital parameters monitor that measure heart rate, body temperature &position(either standing, or lying). Our device will continuously monitor these parameters& send signals to a mobile phone, allowing geriatric patients to live a safe life outside the hospital. It also can be used by young patients suffering from a current attack of illness and need to be continuously monitored.

5.2 Working Principle:

- Our project introduces a portable solution in order to monitor vital parameters of the human body as pulse rate, temperature &position. This will allow the individual to live independently & engage in his daily activities.
- There are four primary vital signs: body temperature, blood pressure, pulse (heart rate), and breathing rate (respiratory rate).
- Our device will continuously monitor vital parameters, &when a certain value limit is exceeded it will warn the holder of a considered mobile phone, to allow geriatric patients to live a safe life outside the hospital.
- The average body temperature is 37 C, but normal body temperature can range between 36.1C & 37.2C or more. Generally, older people have lower body temperatures than younger people have & altered thermoregulatory responses. Thus, we programed the device to give an alarm when the patient's temperature goes higher than 37.5C.
- It can measure the static acceleration of gravity in tilt-sensing applications using an accelerator, as well as dynamic acceleration resulting from motion, shock, or vibration. For this purpose, we used an ADXL 335.
- Measures the 3D motion of the patient by using an accelerometer, LEDs are implemented to show the patients position. So wecan know if it senses a sudden fall of the patient's body.
- Measures the pulse rate of the patient's body.Rates as low as 40 beats/minute may still be considered normal for geriatrics due to slower rates of metabolism. Thus, we

chose that 37 beats/minute will be the trigger to a dangerous situation. We implemented a pulse rate sensor for that.

- In order to send the signals measured, we programed a Raspberry

5.4 Components

Figure 6: Arduino UNO

Figure 7: Triple accelerometer

Figure 8: Temperature sensor

Figure 9: Pulse rate sensor

Figure 10: Raspberry pi

Figure 11: Xbee

Figure 12: WiFi Module ESP8266

Chapter 6:Geriatrics health issues

6.1 Age-related changes in the lungs

- Decreases in peak airflow and gas exchange.
- Decreases in measures of lung function such as vital capacity (the maximum amount of air that can be breathed out following a maximum inhalation).
- Weakening of the respiratory muscles.

Decline in the effectiveness of lung defense mechanisms

6.2 Temperature changes

Lower body temperatures in geriatrics is usually caused by:

- Reduced subcutaneous fat acting as insulation.
- Loss of peripheral vasoconstriction capacity.
- Decreased cardiac output with a decrease in blood flow to extremities
- Decreased muscle mass which results in reduced heat production capacity

6.3 Pulse-Temperature relationship

- Regarding temperature, Geriatrics have slightly lower body temperatures than younger individuals. This could be due to their decreased physical activity or lower cellular metabolism.
- An increase in body temperature indicates inflammation or infection.
- An increase in pulse rate, usually 8 beats per minute for each Centigrade degree, may indicate fever. This may lead to a tachycardia with fever. However, intracellular organisms may cause a bradycardia with fever. This is called pulse-temperature dissociation, or Faget's sign.

- Heat stroke may be caused by extreme fever with temperature higher than 41C.
- Geriatrics that suffer from hypothermia, which is an oral temperature below 35C, can show a delayed contraction phase of deep tendon reflexes.

Chapter 7: Discussion

7.1 Improvements in our device

We can make our device water-proof, engage means of measuring blood pressure, &consider making it more compact. It's also possible to make the device have wireless communications coverage, allowing it to call the ambulance or one of the patients relatives when any of the parameters exceeds or goes below the threshold significantly.

7.2 Advantages of our device

- It will provide you with the essential vital signs information that you require to best serve Geriatrics.
- Can be life-saving in situations where the individual is on his own.
- With many hospitals now very occupied, the demands of patient monitoring have also increased.
- Remote monitoring can even allow patients to live independently.
- Can be used not only for elderly, but also by young people suffering from a current attack of illness.
- Adaptable so as to allow our monitors to be configured with a variety of add-ons to monitor specific vitals.

7.3 Disadvantages of our device

- It will not provide data as accurate as those provided by the monitors in a hospital.
- Can be uncomfortable for the person wearing it.
- They require a monetary investment.

Chapter 8: Price Estimation

Components	Price/ $
Arduino UNO	35$
WiFi Module	5$
Raspberry Pi	50$
Dongle	6$
Triple-axis Acclerometer	7$
Temperature Sensor	4$
Pulse rate Sensor	15$
Buzzer	5$
LEDs	2$

Chapter 9: Conclusion

- As biomedical engineers, we must expand observation of vital signs monitoring in elderly beyond traditional methods.
- Our device should enable home monitoring of patients, eliminating the cost of expensive hospital facilities, allowing a normal life style & reducing the necessity of hospital visits.
- This is particularly beneficial for aged people, giving them freedom of living the lifestyle they want.

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- https://en.m.wikipedia.org/wiki/ESP8266

Appendix

```
int x, g=2, y=3, r=4, b=5;

float temp;

float timemin = 0;

float timemilli = 0;

int Threshold = 540;

int pulse = A2;

float beats = 0;

boolean up = false;

boolean standing=false;

boolean sleeping=false;



void setup() {

  Serial.begin(9600);

  pinMode(g,OUTPUT);

  pinMode(y,OUTPUT);

  pinMode(r,OUTPUT);

  pinMode(b,OUTPUT);

}


void loop() {

  x = analogRead(A0)-339;

  temp = analogRead(A1)*0.488;


  if (x<=40) {

    digitalWrite(r,HIGH);
```

```
  digitalWrite(y,LOW);
  digitalWrite(g,LOW);
  standing=true;
  sleeping=false;
}

if (x>40 && x<=60) {
  digitalWrite(r,LOW);
  digitalWrite(y,HIGH);
  digitalWrite(g,LOW);
}

if (x>60) {
  digitalWrite(r,LOW);
  digitalWrite(y,LOW);
  digitalWrite(g,HIGH);
  standing=false;
  sleeping=true;
}

if(temp>37.5) {
  digitalWrite(b,HIGH);
}
if(temp<=37.5) {
  digitalWrite(b,LOW);

  timemilli = millis();
```

```
  timemin = timemilli / 60000;


  if (analogRead(pulse) >= Threshold /*&& up == false*/) {
    //up = true;
    beats = beats + 1;
    delay(20);
  }


  if (analogRead(pulse) < Threshold) {
    //up = false;
    delay(20);
  }
  float ratefloat = beats / timemin;
  int rate = ratefloat/10;
  Serial.print("temp:");
  Serial.print(temp);
  Serial.print("\t rate:");
   Serial.print(rate);
   Serial.print("\t position:");
   if(standing)
   Serial.println(" Standing");
   if(sleeping)
   Serial.println(" Sleeping");
}
  }
```