

## 2.0 Business Details

### a. Project Abstract

#### ➤ Challenge Statement:

Customers (Sons/Daughters) **feel bad** when Users (elderly/parents) have the following problems:

- Elderly tend to **fall down** often due to aging and health issues
- Have Fear of Intruders and **Theft/Robbery**
- At times, elderly do not pick up the call
- Risk of **Sudden change** in health conditions (Vital signs)
- Face lack of Immediate Medical Assistance
- Not able to call during Emergency (Battery dead, misplaced phone, phone glitches, etc.,)

#### ➤ Use Case:

Initiate the immediate (medical) assistance protocols in case of:

- Health related Emergency: Heart rate (HR) variations, physical injuries (falls)
- Non-Health related Emergency: Intruders, Elderly not picking up calls

#### ➤ Brief Abstract - Idea:

- The solution involves building an ecosystem called **eMars** - Emergency Medical Alert and Response System.

The ecosystem is made up of:

- Wearable Device & an application,
- Response System (24/7 monitoring Center)
- Ambulance/Medical Assistance Dispatchers
- On-Call Doctors/Nurses

- The eMa - **Emergency Medical Alert** is a wearable device which does:

- Automatic Detection - Fall detection, Heart Rate (HR) Variations
- Manual Detection - SOS Button
- Two Way Communication with an embedded GSM (Mic and Speaker)
- GPS Tracking
- UI that gives real-time details about the user

The wearable device does real-time tracking of Falls (physical injuries), bradycardia (Slow HR) and tachycardia (High HR) and SOS button (in case of an intruder). When a detection is triggered, a call is placed to the Response System.

- The RS - **Response System** is a 24/7 monitoring center where there are trained associates who assess the threat level of user during an emergency and then make the call to the Ambulance dispatchers. The assessment of threat-level is done based on the sensor responses from the wearable device as well as the details given by the user during an emergency.

Add-on features may include courtesy calls given to the user twice a week or so, in order to assess their health related needs/issues. If any needs/issues persists a doctor/nurse is sent to their location. (in reference to tie-ups with the HomeHealth

Care Centres -- detailed explanation given in distribution channels)

- The wearable device is priced at a **one-time product fee**, and the response system and the add-on services comes under a **monthly subscription fee**.

➤ **Impact of Solution:**

- **eMars provides “Independency” to the users, giving them the complete sense of relief when it comes to emergencies.**
- An ecosystem such as **eMars** enables both the users (elderly/parents) and customers (sons/daughters) to have a hassle-free and tension free and a no paranoia experience when it comes to any health or/and non-health related emergencies.
- The following jobs are done by eMars:
  - **Functional Job:**
    - Real-time alerts in case of any emergency
  - **Social Job:**
    - Reduce the loss of life due to delayed response
  - **Emotional Job:**
    - Reduces unwanted tension for the users (parents) and customers (sons/daughters)
- **Cost:** What does the customer find too costly?
  - Dependency on others
  - Expensive/uncomfortable for parents to be with a Full-Time nurse/assistant
- **Risks:** What risks does the customer fear about?
  - Parents life are at risk when sudden change in emergency (fall, theft, vital signs, etc.,) occurs
  - Depending on smartphones/phones can be time consuming (phone is in the other room, technical issues in phone)
- This ecosystem is highly **cost-saving** in the longer run as about 62% of elderly people aged 70+ and 41% of people aged between 60-69 encounter some sort of disabilities.  
Such a system **increases** the **standard** of living for all the (users) elderly people, which in turn gives happy sons/daughters (customers).

**NOTE:**

This challenge statement is a result of questioning/interviewing with **32 people** (17 users and 15 customers) in a span of **15 days**.

The run-time view of the solution has not been given, with respect to keeping the abstract of the solution brief.

## b. Market Analysis

### ➤ Target User:

Elderly people who face/have:

- **Dizziness** which is caused by
  - side-effects of medicines,
  - chronic health conditions (heart disease, dementia, low sugar, low BP, etc.,)
  - impairments (poor vision, muscle weakness eg: arthritis, etc.,)
  - environmental risks(wet floor, loose rugs, etc.,)
- Have **bradycardia**(Slow HR), **tachycardia**(High HR)
- Have constant **paranoia** about their health/non health
- Post Surgery patients

and are:

- living with **spouse**,
- living **alone**,
- living with **working sons/daughters** (spend most of time alone)

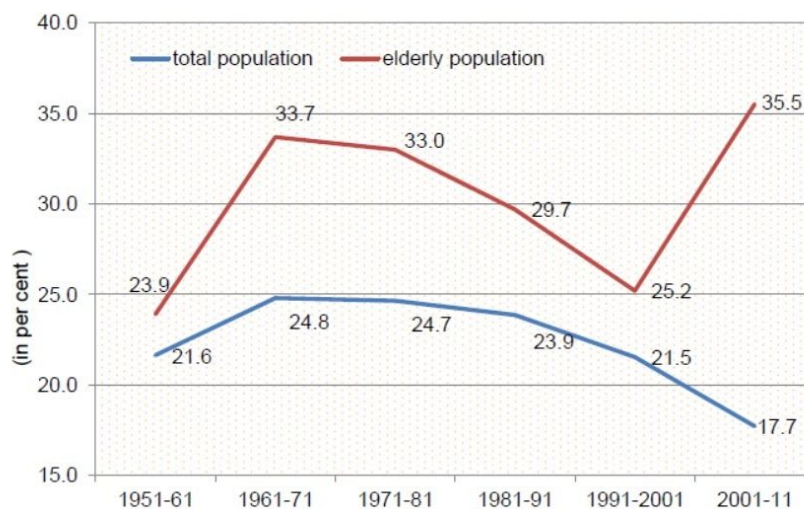
### ➤ Market Segmentation:

Main Category	Segmentation Base	Data	Statistics
<b>Geographic</b>	Country/continent	India, South Asia	
	Region/area of the country	South India - Urban	39%
		West India - Urban	46%
		North East India - Urban	26%
		North India - Urban	24%
		Central India - Urban	24%
		East India - Urban	21%
<b>Demographic</b>	Age group	60+	151M
	Gender	Male, female	50%, 50%
	Marital status	Married, widowed	66%, 32%
	Family life cycle	Married, have kids	
	Family size	Living with spouse/ living with working children/ living alone	56%, 32%, 5%
	Occupation	Retired	
	Education	Literate/Illiterate - Urban	67%, 33%
<b>Psychographic</b>	Social class	Upper Middle Class, Rich Class	5L+/annum
	Personality	Health conscious, paranoia of health, kids who worry/complain about health of parents	
	Health conditions		
<b>Benefits Sought</b>	Needs/motivations	Independency, value, safety	
<b>Behavioral</b>	Buying stage	Gen Y (1981-1996) gathering information on elderly care safety	
	Usage rate	Light, medium	
	Loyalty status	Loyal (As old people do not change brands often)	
	Shopping style	Need based shopping	

## ➤ Total Addressable Market - TAM: (\$21 Billion)

- There are nearly 104 million elderly persons (aged 60 years or above) in India; 53 million females and 51 million males and Rural is 73.3 million and Urban is 30.6million.  
(According to Population Census 2011 )
- This number is expected to grow to **151 million** by 2021 and **173 million** by 2026.  
(According to United Nations Population Fund and HelpAge India)
- The following graph depicts the growth of elderly population over the last 50 years

**Figure 1.2: Decadal growth in elderly population vis-à-vis that of total population**



- The average rate of annual revenue per customer priced at (9k for product avg. and subscription being at 3k avg.) the **TAM is \$21 Billion** in India.

## ➤ Service Addressable Market - SAM: (\$10.7 Billion)

- Currently, the existing market that caters to the needs of the elderly are in the high-growth phase. (In reference to the rapid rise in the Home Health Care centers). The Indian home healthcare market is expected to grow to around \$4.46 billion by 2018 and \$6.21 billion by 2020.  
(According to Health - Economic Times)
- India's market for wearable devices grew 30.9% Quarter-over-Quarter (QoQ) in the second quarter of CY2019 (2Q19) and 123.6% when compared to the same quarter a year ago, reaching an all-time high of 3 million shipments in a single quarter.  
(According to IDC)
- “ 62% of elderly people aged 70+ encounter some sort of disabilities, with people aged between 60-69 at 41%. ” This gives an average of **51% of elderly (60+)** face some sort of **disability**.  
(Disabilities include loss of hearing/speech /visual/mobility/mental health)

Source: 2011 Census of India

- Considering that, only 51% face disability and would want an ecosystem like eMars, The **SAM** is **\$10.7 Billion**.

### ➤ **Competitors Analysis:**

*Competitors **lack one or more** of the following features:*

- Fall detection
- Continuous monitoring of Heart Rate
- GPS tracking
- Button type SOS feature
- SOS limited only to emergency contacts not to response system
- Two-Way Communication

S.No	Name	Country	Response System		Heart Rate		Fall Detection	SOS Button	GPS	Two-Way Communication
			Emergency Contact	24/7 Monitoring	Manual	Continuous				
	<b>Fitness Bands:</b>									
1	Mi Band 4	India	N	N	N	Y	N	N	N	N
2	Fitbit Charge 3	India	N	N	N	Y	N	N	N	N
3	Amazfit Pace	India	N	N	Y	N	N	N	Y	N
4	Honor Band 5	India	N	N	N	Y	N	N	N	N
5	Soufit Sonic V08	India	N	N	Y	N	N	N	N	N
6	GOQii Vital	India	N	N	Y	N	N	N	N	N
7	OMNIN ID115 Plus	India	N	N	Y	N	N	N	N	N
8	Garmin vivo smart 3	India	N	N	N	Y	N	N	N	N
	<b>SOS Devices:</b>									
9	TigerFIT Pro	India	N	N	Y	N	Y	Y	Y	Y
10	Support Elders - Kolkata	India	N	Y	N	N	N	Y	N	N
	<b>SOS SmartWatches:</b>									
11	Apple Series 5	US	911	N	Y	N	N	Y	Y	Y
12	Medical Guardian Freedom Guardian	US	N	Y	N	N	N	Y	Y	Y
13	MobileHelp Smart	US	N	Y	Y	N	N	Y	Y	Y
14	Samsung GalaNy Watch Active	India	Y	N	N	Y	N	Y	Y	Y
15	LimmeN	Switzerland	N	Y	N	N	N	Y	Y	Y
16	Lifebee Smart Watch	Germany	N	N	N	Y	N	N	N	N
17	BingoFit Epic	UK	N	N	N	Y	N	N	N	N
18	LEMFO	UK	N	N	Y	N	N	N	N	N
	<b>SOS Pendant:</b>									
19	Vital Call	Australia	N	Y	N	N	N	Y	N	N
20	Bay Alarm Medical	US		Y	N	N	N	Y	Y	N

(The above chart is a concise version from the detailed analysis of 50 competitors all around the globe done by eMars)

### ➤ **Customer and User - Product Positioning:**

- **Customers** are the Sons/Daughters who are in the working population, may/may not be living with their parents and want to make sure that their parents are in the best care possible, and want a complete tension & paranoia free experience when it comes to the cases of emergencies.

**Features that are highlights to the customer are:**

- An interactive and simple to use/understand User Interface in the form of an application/web portal where the real-time details (eg: GPS tracking, Health Data, etc.,) of the user are displayed.
  - Get information/reports on the application/web portal of the user's health conditions when a lab tests or a doctor visit is done on the application.
  - Ability to set medication reminders for their parents.
  - Prevent the wandering around of elderly/parents (in case of dementia/alzheimers) by using geo-fencing.
  - Notifications to the application in case of low battery or removal of the wearable.
- **Users** are the elderly/parents whose health begins to deteriorate and dependency begins to escalate with age-ing and are often hesitant to share any health related problems to their sons/daughters due to the fear that they might over-burden them.

**Features that are highlights to the user are:**

- Automatic and Manual Detection done by a light-weight wearable watch which gives updates in the event of any irregularities.
  - An emergency SOS call is placed to the Response System where a trained associate is there to assess the threat, and give guidance/help procedures in case of emergencies.
  - Provide a feeling Independency as they can go out anywhere by themselves knowing that they are always under protection.
  - A courtesy call from the Response System allows the users to communicate their distress/health related issues and get a doctor to their doorstep without troubling anyone.
  - A sound alarm to indicate when the device is misplaced.
- **Customer/User** can be the same person when the age group is 50+ and they are working/retired, have illness that can lead to frequent emergencies, and thereby want the best care as soon as possible.
- Features that are highlights for customer/user are common from the above mentioned highlights.

➤ **Distribution Channel Identification:**

- **Old Age/Retirement Homes -**  
They are in the constant look out to improvise their services and give the best care available. An ecosystem like eMars can boost the credibility of such homes and these can be considered as a good distribution channel.
- **HomeHealth Care Centers -**  
There has been an exponential rise in the number of HomeHealth Care Centers all over India, such a rise comes up with a tremendous competition among them. Tying up with centers that are their on the National level and have a trust-worthy standard of services can be a mutually beneficial relationship between eMars and HomeHealth Care Centers.  
(in reference to using HomeHealth Care Centers services for doctor/nurse visits -- their customers become ours and vice versa. We use their services and pay for

them, and they in turn get more customers/users)

- **eCommerce -**
  - Selling eMars through own website, online market places such as Amazon, Flipkart, Seniors focussed market aggregator - Seniority, Medicine Delivery - 1mg, medlife, etc.,
  - Product growth can be boosted by SEO, Social Media Marketing - Facebook, Youtube - Reviewers, Instagram etc.,
- **Offline -**
  - These can be boosted by ads on posters, pamphlets distributed in elderly focused events, retail - pharmaceuticals, etc.,
  - Organizing awareness campaigns in malls/elderly focused events.

## 3.0 Technical Details

### a. Product Brief

#### ➤ Core Technical Innovation:

- The ecosystem by **eMars** - Emergency Medical Alert and Response System provides a wearable device and an easy-to-use application along with it. The core technical innovation is in the Wearable device and the Response System.
- The wearable watch gives real-time alerts in case of any emergencies such as physical injuries - falls, bradycardia(slow heart rate), tachycardia(fast heart rate), intruder alert - manual SOS button. The core technical innovation lies in the '**Fall Detection**' of the device. The ability to assess and differentiate between the simple movements of the hand and actual fall occurrence is done by the software and hardware algorithms in the wearable device.
- The **Response System** is the only type of 24/7 monitoring assistance in real-time, which can assess the threat level and at the same time stay on the line with the user as long as it takes till the necessary help has arrived.  
In this manner, the user gets the necessary assistance and re-assurance mentally that there is no need to panic or be afraid even in critical situations. Thereby contributing to high confidence and strength to the user.

#### ➤ Uniqueness - Product Design:

- The uniqueness of the product lies in wearable watch being a '**stand-alone**' device. This means that the device does not need to be connected to your phone via bluetooth or wifi connection. The device comes with an e-sim, enabling it to connect to the internet to send/receive data automatically.

- Along with this, the usage of mic and speaker gives access to **two-way communication** between the user and the caller. Thus, the wearable watch can be used **indoors** and **outdoors** without any issues in reference to the connectivity to the phone/wifi.
- Apart from this, the watch is waterproof and can be used while bathing, or during rain. The watch is also light-weight and durable.

➤ **Objective - Proposed Solution:**

- The solution involves building an ecosystem called **eMars** - Emergency Medical Alert and Response System.

The ecosystem is made up of:

- Wearable Device & an application,
  - Response System (24/7 monitoring Center)
  - Ambulance/Medical Assistance Dispatchers
  - On-Call Doctors/Nurses
- The eMa - **Emergency Medical Alert** is a wearable device which does:
    - Automatic Detection - Fall detection, Heart Rate Variations
    - Manual Detection - SOS Button
    - Two Way Communication with an embedded GSM (Mic and Speaker)
    - GPS Tracking
    - UI that gives real-time details about the user

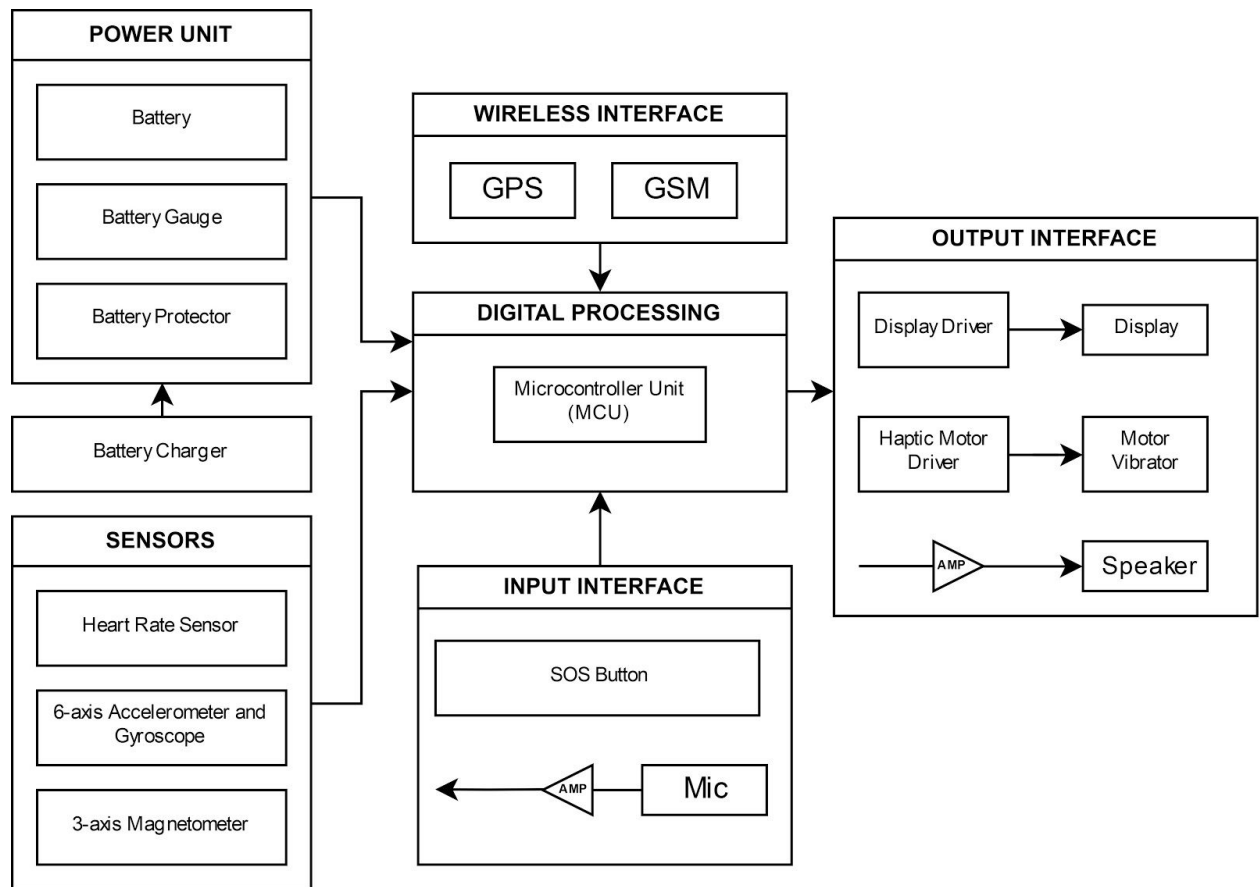
The wearable device does real-time tracking of Falls (physical injuries), bradycardia (Slow HR) and tachycardia (High HR) and SOS button (in case of an intruder). When a detection is triggered, a call is placed to the Response System.

- The RS - **Response System** is a 24/7 monitoring center where there are trained associates who assess the threat level of user during an emergency and then make the call to the Ambulance dispatchers. The assessment of threat-level is done based on the sensor responses from the wearable device as well as the details given by the user during an emergency.  
Add-on features may include courtesy calls given to the user twice a week or so, in order to assess their health related needs/issues. If any needs/issues persists a doctor/nurse is sent to their location. (in reference to tie-ups with the HomeHealth Care Centres -- detailed explanation given in business details -- distribution channels)
- The wearable device is priced at a **one-time product fee**, and the response system and the add-on services comes under a **monthly subscription fee**.

## **b. Proposed Design**

### **BLOCK DIAGRAM:**





### ➤ Output Interface:

- The Display of pixel size 360x360 is used to display the HR values, date, time, network availability, Incoming call notification, and other necessary indications. It is connected to a display driver which acts as a connecting interface to the MCU.
- There is a speaker placed which is used for the two-way communications used during emergencies and also used for applications like giving a sound-alarm in case the watch is lost (with respect to pressing the necessary option on the application). The speaker is also connected to an amplifier to provide amplification.
- A vibration motor is present to give the necessary indications and notifications like SOS alert, HR variations, Fall detection. The vibration motor is connected to a haptic motor driver which is connected to the MCU.

### ➤ Input Interface:

- There is a Push Button placed which is used for functions like SOS Alert (4 seconds press) to the Response System in case of emergencies, and for other related processes.

- The mic is used for communication during an emergency and non-emergency, also it is used for one-way communication if a theft/intruder alert is detected. The mic is also connected to an amplifier to provide amplification.

### ➤ **Wireless Interface:**

- GSM is used for implementing the two-way and one-way communication. Apart from this, it provides the necessary network connectivity needed for the device to connect to the internet. The transmission and receiving of data is done through this internet connectivity, enabling the device to be a stand alone device which can be used both indoors and outdoors.
- GPS is for giving the location of the user in real-time during an emergency, or if requested from the application. This is helpful in providing the geo-fencing techniques, if needed for the user.

### ➤ **Sensors:**

- The Heart Rate sensor is used for detecting the heart rate values which is helpful in finding out conditions like bradycardia or tachycardia after applying the necessary software filters.
- Motion Detection sensors such as 6-axis accelerometer and gyroscope is used to indicate if the user has occurred a fall. A brief supporting explanation of the process of fall detection is as follows:  
 The fall is detected by using the threshold method. The threshold values are taken from a trained fall data (including forwards, backwards, sideways) and ADL (including walking, running, jumping, going downstairs and going upstairs). The SVM (Single Vector Magnitude) is used for detecting the falls ( $SVM = \sqrt{A_x^2 + A_y^2 + A_z^2}$ ). Most of the falls have high SVM value compared to the normal value. So, initially peak value is detected. To differentiate the SVM value from normal activities the base length of the triangle is calculated. The velocity after the impact is utilized to distinguish sudden moves, like jumping, quickly sitting on a bed or physical exercise.  
 When the fall happens, the first peak value reaches the threshold we set. And then, the second peak value follows which lower than the threshold we set. At last, the acceleration back to normal.  
 However, when we are running, the peak values all exceed the pre-set threshold and the time interval between the peak values is smaller than the one in fall experiment. For that we use variable count algorithm to count when above mentioned scenarios are satisfied. Otherwise we should consider it is as a running event.  
 Additionally, fall detection algorithm adds the vertical acceleration as a verified procedure. Vertical acceleration is calculated by  $|A_v| = |A_x \sin \theta_z + A_y \sin \theta_y - A_z \cos \theta_y \cos \theta_z|$ . We set threshold value for vertical acceleration, it changes before and after the fall. Based on this, the fall is detected.
- The 3-axis magnetometer is used for finding the direction, strength or relative change of magnetic field at a particular location. It is used for both fall detection as well as in

location tracking.

➤ **Power Unit:**

- Lithium Polymer (LiPo) batteries are used for supplying the necessary power for the system. A battery gauge is present for indication of the battery status.
- The battery protector monitors the battery voltage and controls charging/discharging. If in the event that over charging/discharging occurs, it uses FET to stop the process.

➤ **Digital Processing:**

- An ultra low power Microcontroller Unit is used for the digital processing of all the data from the sensors, input interface, output interface. This data is then transmitted to the cloud, so that the user can view the data in the application. In case of emergency, it is used to process the communication to the Response System.

### c. Innovativeness of the Proposed Solution

➤ **Competitors Analysis:**

- Currently, competitors in this Elderly Care industry are scattered. There are Fitness Bands in India whose prime focus is on fitness based sensors and data, and HomeHealth Care Centers who focus on home based health care, and Medical wearables which give medical grade data when needed. A device that provides both automatic and manual detection with a monitoring assistance is not done by any competitors as of now.

*Competitors **lack one or more** of the following features:*

- Fall detection
- Continuous monitoring of Heart Rate
- GPS tracking
- Button type SOS feature
- SOS limited only to emergency contacts not to response system
- Two-Way Communication

(NOTE: In-depth analysis of competitor's features are done in section 2.0 Business Details -- b. Market Analysis -- Competitors Analysis)

➤ **Major Differentiators:**

○ **Fall Detection:**

- The '**Fall Detection**' which is being done by a few competitors in the Global level has not been very effective in the wearable watch sector. The wearable watch by eMars aims to solve this hurdle, therefore it is a core feature of the device. The elderly are prone to falls frequently and if not treated in time, this may escalate to internal bleeding. Ultimately leading to severe consequences,

at times even death.

- **Continuous Monitoring of Heart Rate:**
  - This functionality enables the continuous assessment of conditions like bradycardia and tachycardia. The heart rate can be a useful tool in identifying any abnormalities that might arise in an elderly user. Identification of such an abnormality can lead to early detection of any health issues.
- **Two-Way Communication:**
  - Two-way communication greatly increases the customer/user experience as it eliminates any miscommunication. This improvises the service the user gets in case of any emergencies and can be life-saving.
- **GPS Tracking:**
  - GPS Tracking enables the tracking of user regardless of his location. This means that the user can wear the wearable watch indoors and outdoors without any fear. A pre-built address based monitoring system is not as effective as GPS tracking.
- **Button Type SOS Feature:**
  - This feature is helpful during any invasion by an intruder/thief as in such a scenario an option of 1 way communication can be done and the situation can be assessed and necessary protocols can be followed.
  - In the event of a chest pain or any other type of symptom that the user feels and wants to receive medical assistance, the button type SOS feature is of assistance.
  - Also, this can also act as a fail-safe if the automatic detection fails.
- **Response System:**
  - The 24/7 monitoring service ensures that the user is in safe hands and need not be worried of factors like time, location, etc., The response system also acts as a hub of other resources that the elderly can make use of. This includes resources such as medical aid done by a doctor/ lab tests that need to be arranged/ medicines that need to be delivered.

## **d. Impact of the Proposed Solution**

### **➤ Disability:**

About **52%** of elderly (60+) face disabilities (visual, hearing, mobility, mental health, speech) and this leads to higher chances of health related emergencies. Also, About 12% face multiple disabilities. This data clearly shows that the elderly people begin to struggle with age in doing their day-to-day activities.

### **➤ Chronic Diseases:**

The major risk factors for elderly people include that of chronic diseases like Arthritis, Hypertension and Heart diseases, where heart disease is the biggest cause of death (about

28%). About **1 in 3 has hypertension**, and patients with low/high BP/sugar faint and this needs to be treated within **2-3 hours** else this can lead to harmful effects such as coma & worse case is death.

➤ **Living Alone/Depression:**

Also, according to a study published in Neurosciences in Rural Practice in 2011, about 22 percent of the elderly in India or **every fifth** elderly in the country—are **depressed**.

By 2025, 25% of those above 60 and **40%** above **75** are likely to be **living alone**. Thus, this enables the need for proper systems which need to be in place to ensure independence and confidence in the elderly is necessary.

➤ **Unintentional Falls/Injuries:**

About **1 in 10 falls** sustains a fracture, if this might be internal fracture it needs to be treated immediately. About 4% of the falls results in death.

➤ **Robbery/Intruders:**

The fear of intruders/robbers taking advantage of the elderly and forcing themselves has also been a major concern. Any attempt to call emergencies can in turn be very harmful. About **7%** of the total crimes against senior citizens comes from **Robbery**.

➤ Some general facts about the Indian demographic are:

3.7 million suffer dementia, 40 million suffer from poor vision, 1 in 3 suffer from arthritis, 1 in 5 has diabetes, 1 in 5 has auditory problems, 1 in 4 suffer from depression

➤ The rise of home health care centers throughout India in the last few years, justifies the importance/need of elderly care. The Indian home healthcare market is expected to grow to around \$4.46 billion by 2018 and \$6.21 billion by 2020.

With various home health care centers set up to minimise the cost and to improve the efficiency of health care programs for the elderly in a home based set up, this paves the way for eMars to play a vital role to enhance the Elderly Care Industry.

**Disclaimer:**

The source of the data provided in the documents provided are from the “**2011 Census of India, 2001 Census of India, Crime Statistics of India**”.