

# COVID-19 Lockdown Devastated Livelihood - Safe Back to Normality with Smart Jacket Prototype

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## Abstract

We see a worrying rise of COVID-19 cases globally, every day. Many countries imposed nationwide lockdown, ordering their people to stay home with nearly all services suspended. On other hand, due to this strict lockdown, COVID-19 poses severe economic challenges in securing the necessities of life, for the majority of the population. Many countries are now facing the threat of high inflation and increasing unemployment. Not only employees are suffering, but it is also very important to note that, more than 150 crore students, globally, are seriously affected by the sudden shutdown of educational institutions, UNESCO said. Undoubtedly Lockdown is one of the best weapons to stand against this pandemic by it costs an economic downturn. Presenting various thought-provoking facts that explain the dire need for human beings to get out of the home for survival, in this work, we proposed a smart wearable jacket (prototype), which is a technological combination of hardware and software that can be used to sense and respond, ensuring a safe physical distancing to restart the normal life, by safely being a part of unavoidable crowded situations like, during the utilization of public transportation facilities while commuting to workplace, educational institutes and various essential needs.

**Keywords** - COVID-19, Livelihood, Financial Disaster, Physical Distancing, Raspberry-Pi, Smart Jacket

## 1. Introduction

A total of 8,993,659 confirmed cases of COVID-19, including 469,587 deaths, reported to WHO globally, as of 23 June 2020 (as of 3:58 pm CEST); Americas - 4,437,946, Europe - 2,562,642, Eastern Mediterranean - 933,052, South-East Asia - 620,115, Africa - 232,215, Western Pacific - 206,948. This alarming situation changed the work-life of most of us, creating the impact being felt at multiple levels resulting in financial slowdown, personally and globally. Every part of the world is currently in some degree of lockdown. How far our basic livelihood survives lockdown? For this question, undoubtedly we can say that livelihood cannot survive the lockdown anymore. The situation arises, where we have to unlock ourselves and continue our normal life, more safely. Along with various measures we have already cooperated into our daily life, Social Distancing is the best tool to slow down the virus spread locally and globally.

### 1.1 Understanding the Global Problem with Case Study: INDIA

Elaborating most recent United Nations information as of Tuesday, June 23, 2020, the current population of India is 1,379,743,435, sharing 17.7% of the total world population with 28.4 years median age [1]. Figure 1 indicates the workforce distribution of this country; the graph is drawn based on the data from trusted sources [2].

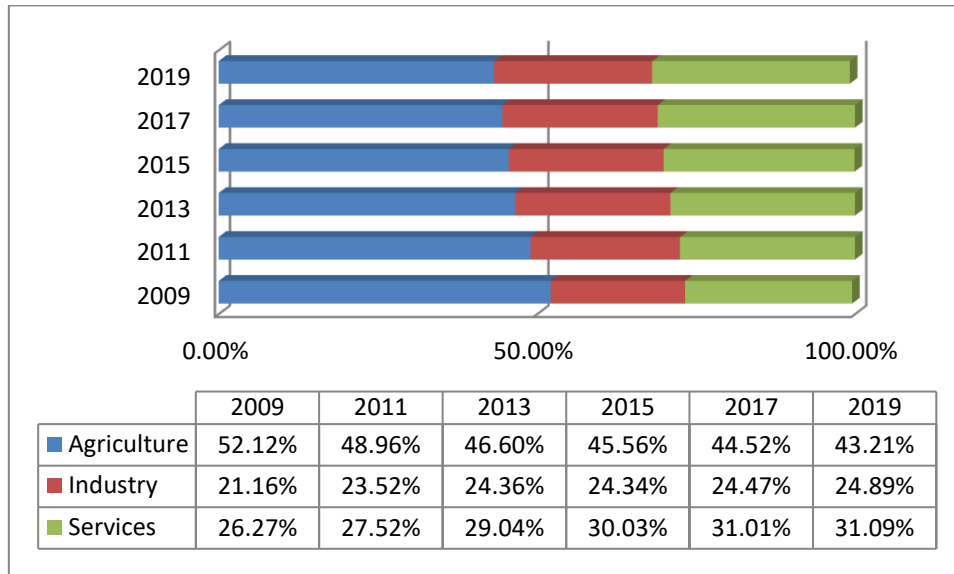


Figure 1 - Indian workforce distribution - the percentage of workforces

With a large network of institutions providing higher education, India plays a vital role in the international education industry. There are 39,000+ colleges and 900+ universities in India, with higher education enrolment of 37+ million students with a net enrolment ratio of 26.3 percent [3, 4].

### 1.2 India under COVID-19

Aiming at the containment of COVID-19 spread, the country observed a nationwide complete lockdown for 21 days starting from March 25 2020 which resulted in a sudden stop of 70% economic activity. Only essential goods and services were permitted to work [5].

Studies carried out by Centrum Institutional Research concluded that complete lockdown is probably going to shave off a very large amount of Rs 8 trillion. Acute Ratings and Research Ltd evaluated that the lockdown will cost the Indian economy nearly Rs 35,000 crore every single day and the whole 21-day lockdown will bring about a loss of practically 7.5 lakh crore, in GDP [5].

As per Crisis Research, this increasing financial interruption is going to bring about a perpetual loss of the country's GDP around 4%. In other words, as time passes by, while the economy is likely to recover there will be a certain amount of economic activity that will not be recovered and this is assessed to be 4% of GDP [6]. Special financial packages are released by the Indian government given supporting the country's economy, but the economists are saying that those packages are not going to show an immediate positive impact on growth.

Goldman Sachs, an international level investment bank, has anticipated that the country's economy will encounter the most exceedingly awful downturn as its already weakened economy was additionally hit down by this complete national level lockdown to control COVID-19 [7].

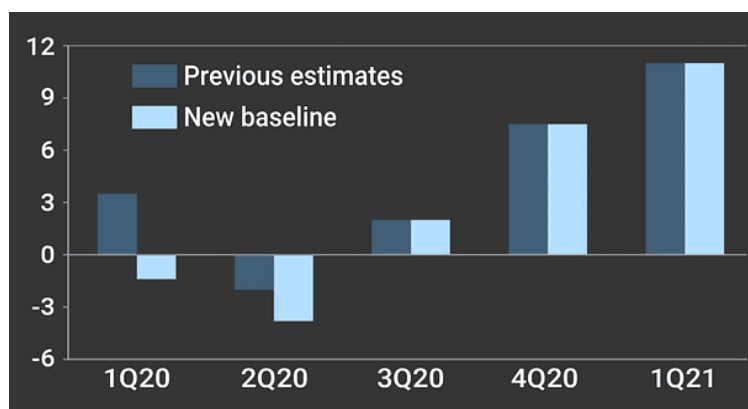


Figure-2 - Estimates on Indian GDP by Goldman Sachs

Figure 2 shows the latest trends of the Indian GDP forecast by Goldman Sachs [8]. It shows two different estimates where the first one is the previous and the second one is the latest, after the country hit with Covid-19. In parallel country also experiencing the rise of cases and unable to break the chain of COVID-19 transmission completely and even the country occupied a place in the list of top 10 countries with the highest number of cases as shown in Table-1; Data Source - WHO.

Table-1- Data Tabulated on Jun 23, 2020

S.No.	Country	Total Cases	Deaths
1	UNITED STATES	23,88,225	1,22,611
2	BRAZIL	11,11,348	51,407
3	RUSSIA	5,99,705	8,359
4	INDIA	4,41,643	14,027
5	UNITED KINGDOM	3,05,289	42,647
6	SPAIN	2,93,584	28,324
7	PERU	2,57,447	8,223
8	CHILE	2,46,963	4,502
9	ITALY	2,38,720	34,657
10	IRAN	2,09,970	9,863

The current crisis has brought high stress upon Indian employees as well as organizations. Many individuals are suffering from fear of job loss and pay cuts are already observed with some and almost everyone is experiencing delayed appraisals [9]. The ongoing lockdown along with the fear of COVID-19, have left employees feeling stressed over their future. The situation is like, the people can't stay inside without working for their survival, and on the other hand, the people can't come outside and work with the fear of COVID-19 infection.

Likewise, the education sector is amongst the many which have taken a solid blow because of the COVID-19 circumstance. Schools are closed, and students are abandoned at home, with fully restricted contact with friends and no physical movement. recognized boards have postponed or dropped examinations. Top Indian organizations like IITs and IIMs have all shut their grounds and moved classes on to the web. Indeed, tests like GMAT, GRE, SATs, ACT stay suspended and the eventual fate of numerous students hangs in balance [10]. The notable fact unleashed by UNESCO is, girls will be the worst hit by this pandemic situation as it will prompt increased drop-out rates leading further to the development of unnecessary gender gaps in education [11].

### 1.3 Unlocking Ourselves with Safety Measures; Social Distancing

It will not be able to minimize both COVID-19 spreads as well as the economic impact of viral spread, in parallel [9]. On another hand, it is horrible to estimate what the losses would be in the future if this situation remains the same. Scientists around the globe are well en route to finding immunizations and medicines for the infection, however, even in a most ideal situation, these are probably 12-18 months away [10]. Until then, extreme social distancing is pretty much the only intervention available to help people stay away from getting infected with the virus. The World Health Organization recommends at least a meter or a little more than 3 feet and some countries defined their own rules too, varying from 1m to 2m. These distance suggestions are all founded on long-standing logical investigations of what number of respiratory infections, including coronaviruses, is transmitted. Droplets are too little to even think about seeing however almost too enormous to even think about floating, travel by cough, sneeze, or speech from the nose and mouth of a tainted individual to someone else, or to surfaces.

But as we have already habituated to wear proper good quality face masks and we are also habituated to carry sanitizers, and we are also taking a lot of measures, so here in the proposed work, we have taken 1 Meter as the safe and ideal social distancing distance. One more reason for this 1

Meter consideration is, our proposed model is well suited in the crowded environments like Metros, Buses, Schools, Colleges, where we cannot take more than 1 meter as an ideal distance, as per the ratio of several users and those location constraints.

#### 1.4 Potential of Wearable Technology / Smart Garments

Technology has become ubiquitous; it is all around us and is becoming part of us. The capability of smart garments nowadays is, they can connect with smartphones can process various vital information such as heart rate, body temperature, breathing levels, stress levels, etc. [11].

Here in this paper, we proposed a simple Jacket Prototype, which enables the user to maintain proper social distancing / physical distancing. The proposed prototype model can be used in many places like; public transportation, shopping malls, hotels, markets, workspaces, educational institutions, etc.

#### 2. Proposed Model

Figure-3 shows the proposed model; was in that we had 3 people assume that they are in the metro station. The second person (middle) is wearing the proposed jacket prototype and he is walking. The jacket keeps on detecting an obstacle / another person in the one-meter distance, both front and back sides. This detection is carried out by two ultrasonic sensors, which are placed on both sides of the jacket (one in front & one in back). The red colour arrow representation specifies that the front ultrasonic sensor detected the person in front of the user, whose distance is <1 meter from the user. Then immediately the vibration motor, which is placed in the front side of the jacket will get activated and alerts the user that he not in a safe social distance and along with this, the high contrast LED, which is located inside the collar of the jacket will start blinking for 3 seconds, this will be useful to alert the user as well as the surrounding people. The same will happen with the backside part of the jacket, there is a backside ultrasonic sensor and backside vibration motor and even the collar light will be enabled if there is any person found in < 1-meter distance.

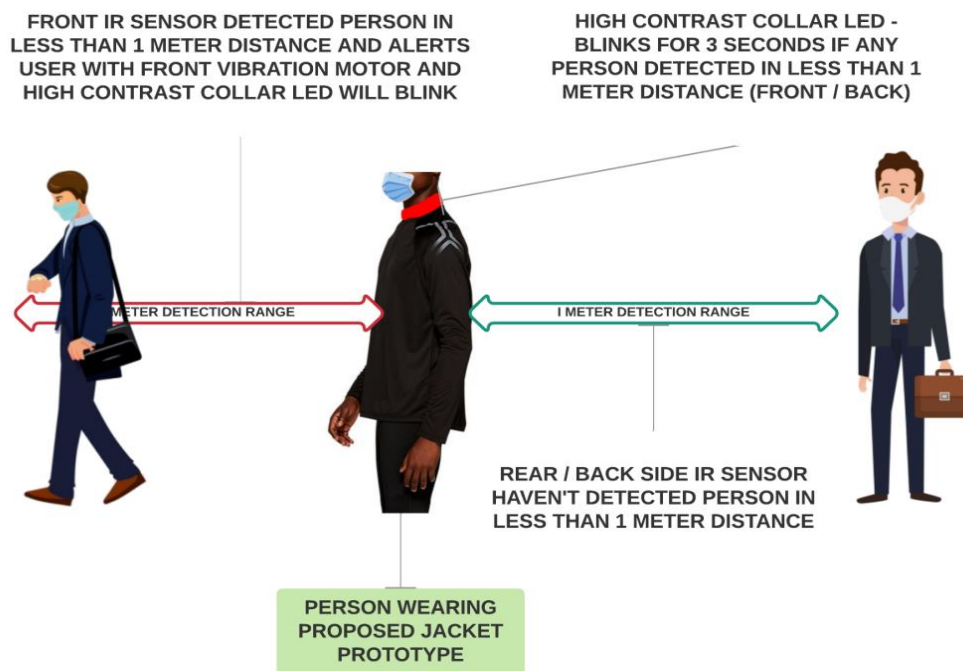


Figure-3 - Overview of the proposed model (with 1-meter range)

Considering blind people also, we have added one more option, where the user will also get, voice input saying that “there is a person in front of you in <1 meter” or “there is a person behind you in <1 meter” (it depends on the direction in which the obstacle is detected). The more detailed architecture will be shown in the further Methodology section.

### 3. Methodology

Figure-4 is the architectural overview of our proposed system, which explains the technical connections between the internal modules of the proposed model. As mentioned there, the power supply is given to the raspberry pi using a portable power unit (pocket power bank). When the pi gets activated, it activates both (front & back) ultrasonic sensors and waits for them to settle. Once the sensors get settled, the pi gives a signal to the sensors upon which the sensors transmit the ultrasonic waves continuously. When these waves are reflected, by hitting an obstacle, raspberry pi calculates the distance between obstacle and sensor.

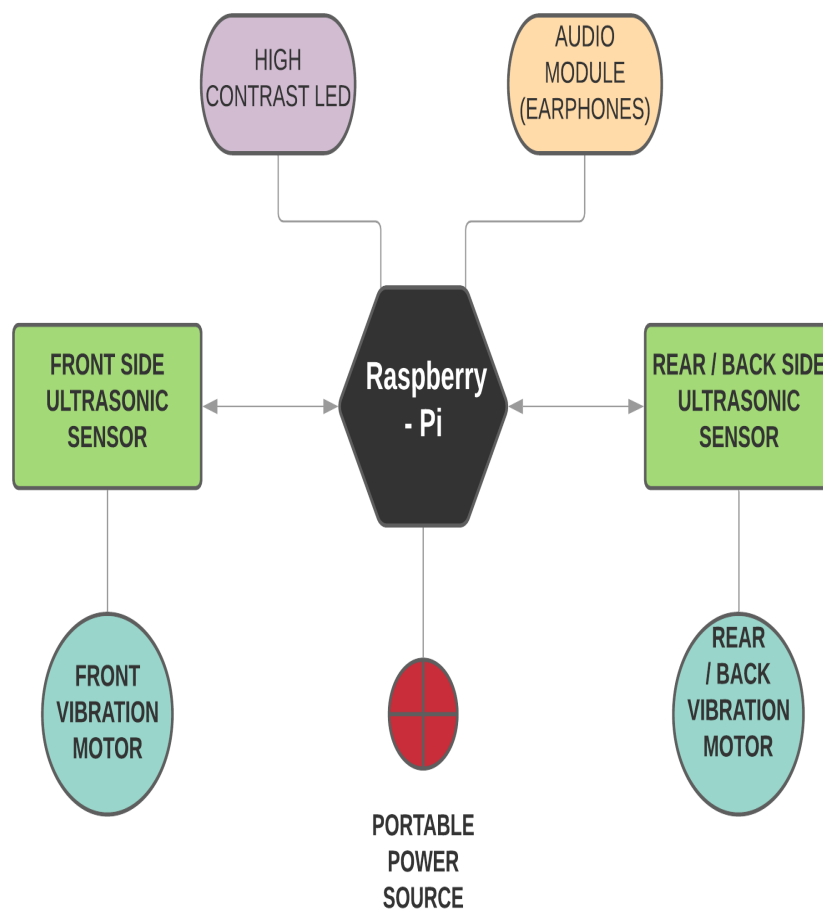


Figure-4 - Architectural overview

Whenever this calculated distance is  $<100\text{cms}$ , the raspberry pi activates the vibration motor (front/back depends on the direction in which the obstacle is detected) and collar LED, as an alert. Along with this, if the earphones are plugged into a 3.55 mm jack, available on Raspberry-Pi, then the user will also get the voice instruction, saying that “there is a person in front of you in  $<1$  meter” or “there is a person behind you in  $<1$  meter” (it depends on the direction in which the obstacle is detected).

### 4. Experimental Setup

Figure-5 shows the experimental setup of the overall proposed prototype setup and this model is driven by python programming.

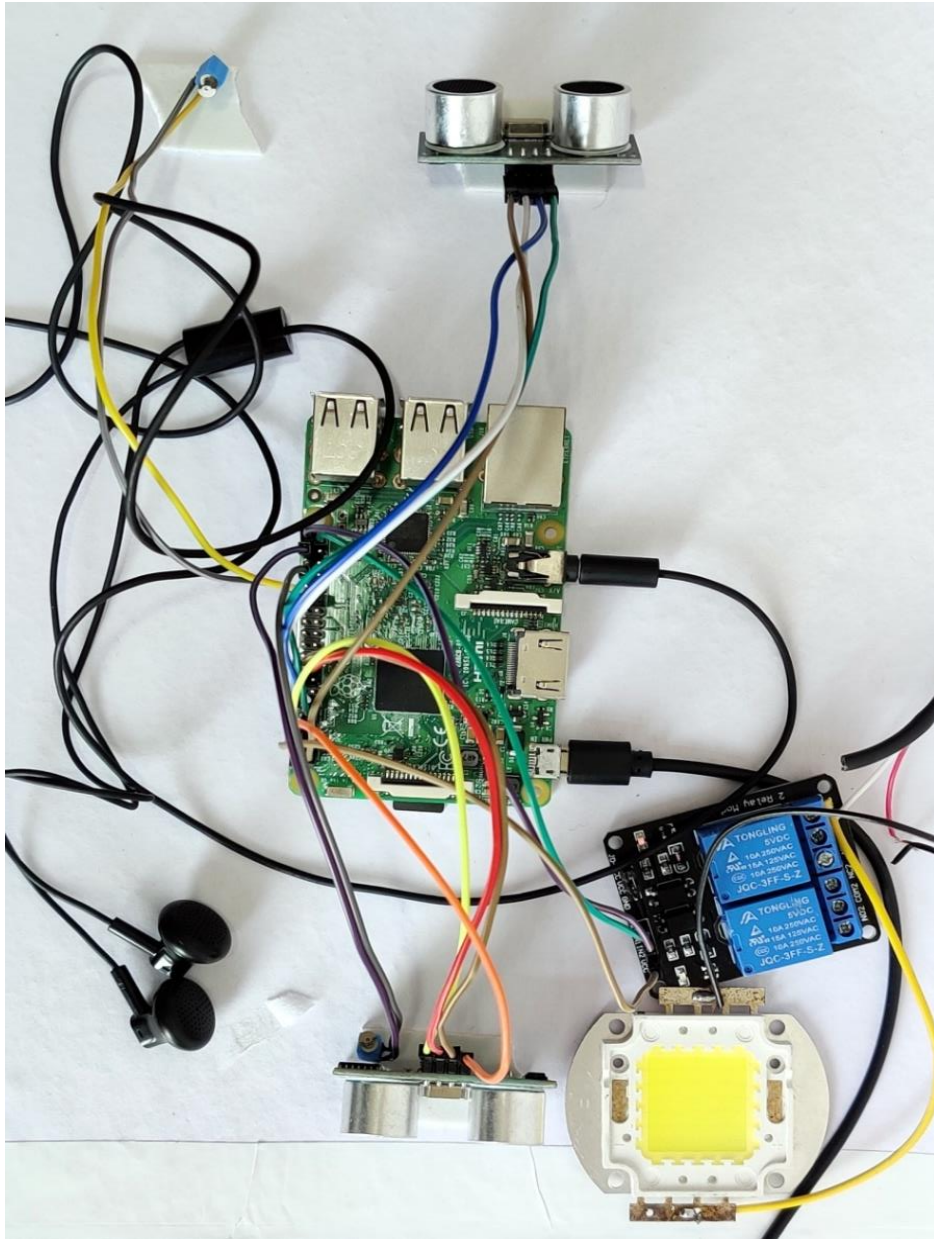


Figure-5 - Overall experimental setup

## 5. Testing & Results

As shown in Figure-8 the overall setup is mounted on cardboard in such a way where, on one side, there is a front ultrasonic sensor, front vibration motor, and on another side back ultrasonic sensor and back vibration motor are set. Led is placed in the middle of the cardboard and you can also see the earphones plugged into the earphones port of Raspberry-Pi. And the whole setup is placed on a flat surface which is above 1 meter from the ground and we considered it as an active proposed Jacket model and for testing, we have placed two people front and back of this setup, and observed various results, while testing with different cases. For better understanding, Table-1 shows the continuous distance measurements and their respective activities. These are the few readings returned from front/back ultrasonic sensors, which we have taken from the python execution environment. Case 1: Person is not detected in the front and also in the backside of the user in the range of <1 Meter.



Figure-6 - Testing - CASE 1

Observations:

- Front / Back vibration motors not activated.
- High Contrast Collar LED not switched on.
- No voice alert

Case 2: Person is detected in front in the range of  $<1$  Meter and not detected at the backside of the user.

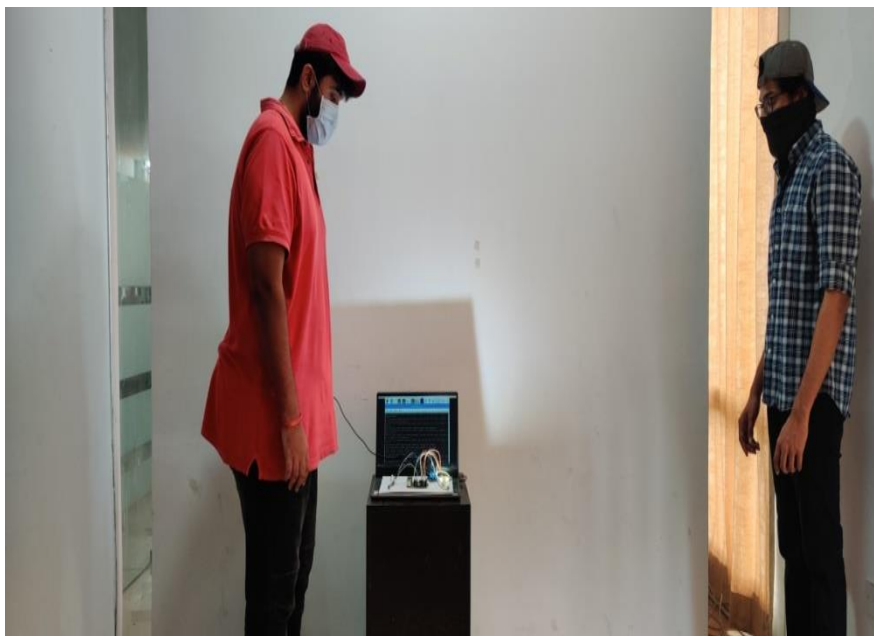


Figure-7 - Testing - CASE 2

Observations:

- Front vibration motor activated.
- High Contrast Collar LED switched on (lighting can be seen on the wall)
- Voice alert saying, “there is a person in front of you in  $<1$  meter”

Case 3: Person is detected in the backside in the range of <1 Meter and not detected at the front side of the user.



Figure-8 - Testing - CASE 3

Observations:

- Back vibration motor activated.
- High Contrast Collar LED switched on (lighting can be seen on the wall)
- Voice alert saying, “there is a person behind you in <1 meter”

Case 4: Person is detected in the front and also in the backside of the user in the range of <1 Meter.



Figure-9 - Testing - CASE 4

Observations:

- Front & Back vibration motor activated  
High Contrast Collar LED switched on (lighting can be seen on the wall)  
Voice alert saying, “there is a person in front of you and person behind you in <1 meter”



Table-1 shows the continuous distance measurements (distance between the encountered obstacle and the sensor), observed by both front and back ultrasonic sensors and the respective triggered activities, illustrating the above-mentioned cases.

Table-2 - Readings and triggered activities

ULTRASONIC SENSOR	DISTANCE SENSED	VIBRATION MOTOR STATUS		COLLAR LED STATUS	AUDIO FEEDBACK
		FRONT	BACK		
<b>CASE 2</b>					
FRONT	161.6 cm	NO	NO	NO	NO
FRONT	175.45 cm	NO	NO	NO	NO
FRONT	85.62 cm	YES	NO	YES	YES
<b>CASE 3</b>					
BACK	376.66 cm	NO	NO	NO	NO
BACK	161.95 cm	NO	NO	NO	NO
BACK	94.11 cm	NO	YES	YES	YES
<b>CASE 1 &amp; CASE 4</b>					
FRONT	161.44 cm	NO	NO	NO	NO
BACK	306.28 cm	NO	NO	NO	NO
FRONT	30.22 cm	YES	NO	YES	YES
BACK	97.53 cm	NO	YES	YES	YES

## 6. Conclusion

Lockdown plays a major role in reducing the transmission of the COVID-19, but at what costs of economic survival? Getting a vaccine will take at least a few months, in the best case. Pandemic survival and economic survival are two different things that we are unable to deal with at an ease. The lockdown to contain the spread of COVID-19 is having and will have a huge impact on the economic provisions and livelihood of the majority population. A longer lockdown may create discrete chaos in everyday life. The proposed idea may enable us to start daily activities in a safe and calibrated manner. Proposed work can be extended further in many beautiful ways by adding various analog and digital sensor modules to the Raspberry-Pi, as the scope of this processor is limitless.

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