COVID-SMD: CHILD OLDSTER VICTIM ILL DUMB-SAFETY MONITORING DEVICE

Mansi Kashyap[2], Shuchita Saxena[1], Kshitij Shinghal[1], Amit Saxena[1]

[1]Assitant Professor, Electronics and Communication Engineering department, Moradabad Institute of Technology, Moradabad

[2]Student, Bachelor of Technology (ECE), Moradabad Institute of Technology, Moradabad

ABSTRACT

Pablo Picasso quoted "Without great solitude, no serious work is possible". COVID – 19 the deadly widespread epidemic taught this that in desolation one can come up with a great idea and some out of the box suggestion or design. This paper presents such project that is made in solitariness due to the pandemic. Here a prototype is described for the frontline warriors of novel Corona virus. Besides this it would also be very helpful for monitoring of health, activities and tracking our loved ones. The prototype is named as COVID-SMD and abbreviated as Child Oldster Victim Ill Dumb Safety Monitoring Device. It consists of five modules which would tell us about the temperature, surrounding light, fall, removal of the device and emergency situation. It would monitor the temperature of the wearer, will keep a track of location, alert about the fall of the person, detect if person is in dark and will also help your loved ones in their panic situation. It will send alert messages to the phone number saved in the source code. This device would be productive for both parents who want to monitor their kiddos, as well as for children to supervise their golden age geriatric parents. It would be essential for the person suffering from various diseases such as dementia (short term and long-term memory loss), autism (nervous breakdown), Alzheimer (loss of functioning of brain). At present time of Pandemic Safety and monitoring of children, elderly people, dumb people handicapped, patients where social distancing is very important.

Keywords: *COVID-19 pandemic, Wearable Device, Arduino, Safety, Monitoring, tracking, High Temperature, device took off, Panic button, GPS, GSM, GSM mobile communication, SMS based, Sensors, Security, Darkness, LDR, LM35, GY-61, 3-axis Accelerometer, buzzer, Child, Oldster, Victim, Ill, Dumb, Safety Monitoring Devices.*

I. INTRODUCTION

COVID-SMD is Child Oldster Victims Ill Dumb Safety and Monitoring Device. This device would be helpful for child's safety as parents could continuously monitor their kid. It would notify if child is in dark i.e., he/she may had hidden himself/herself in cupboard, or they may have fallen in a pit. This would be a convenient device for the geriatric parents as it would assist them in apprising their children about any of the issue, they will be facing like high temperature on any panicking situation. It would be favorable to forewarn the loved ones of the victims such as COVID patients, teased females, nervous or afraid children while playing outside, little ones might fall in manhole or pits. Ill ones could send an emergency signal by just by pressing the button and can call their caretakers, their continuous temperature monitoring would also be done and also an alert could be sent if they fall due to uneasiness. It becomes essential for the Dumb person as it would keep a track of their temperature and location. It will send a message if they get into dark by mistake or there is a sudden fall.

Safety and monitoring of children, elderly people, dumb people handicapped, patients at this present time of Pandemic where social distancing is very important, is becoming a current need to help the world to fight against COVID-19 and also in the coming future. Device will send an alert to the authority if patient falls, is in dark, presses the panic button or high temperature is detected. This device would be helpful for parents to keep eye on their child, Children for taking care their elderly or aged parents, Caretakers of Dumb and Handicapped, Patients, Sick person. This device is small in size, cost effective,

SMS based, user friendly, light weight, comfortable, easy to use wearable device which sends the alerts automatically as soon as the limit exceeds. It does not rely on Wi-Fi, Bluetooth, Internet or any android app as they all have their limitations of range and connectivity issues. Moreover, these are unreliable means of communication i.e. why we have made our device SMS based.
This a device would be a warrior for our medical teams to tackle load during the situation of COVID-19 pandemic. It would help in monitoring patients without getting in contact with them which will prevent medical community to keep them safe from corona virus. This would be helpful for tracking the patients who ran away from the isolation wards and will also help in knowing their travel history. It will alert the staff if high temperature is detected or if patients faints. There is panic button which patient could press and call the nurse or doctor for their help if they feel sick. It is SMS based system so reliable communication is possible.

II. BLOCK DIAGRAM

In Figure 1, block diagram of COVID-SMD is shown. It can be seen that Arduino nano is used as the heart of the device. Besides that, three sensors are used LDR, LM35 and GY-61. LDR is used for two purposes one to detect the darkness and the second to know about the device took off. LM35 is used for temperature monitoring and GY-61 accelerometer is used for the detection of fall. Apart from this it consists of an emergency button for any kind of trepidation. These all sensors and panic button are connected with Arduino which sends alert in form of SMS through GSM along with the location tracked from GPS [11].

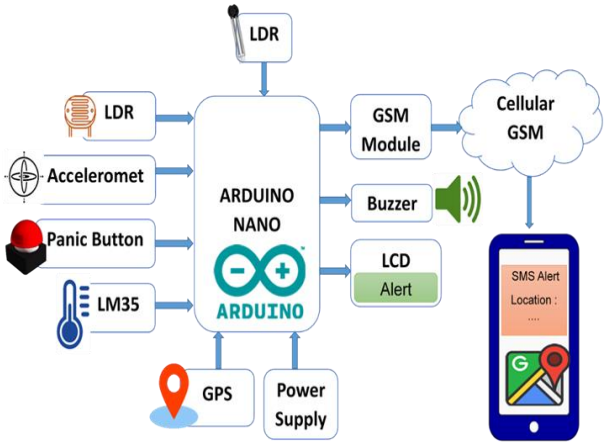

Figure 1 Block diagram of COVID-SMD

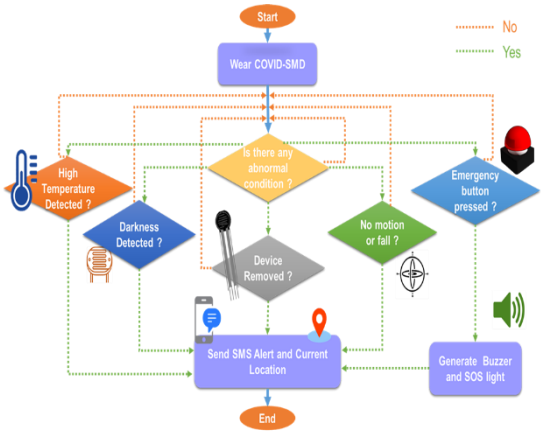

Figure 2 Flow Diagram of COVID-SMD

III. WORKING OF COVID-SMD

The basic working of device is that the particular threshold values are feed for sensors like temperature sensor LM35[2], force resistive sensor, photoresistor or LDR [12] and accelerometer, if the prototype exceeds these predefined threshold values and if the gadget gets exposed to abnormal or unusual condition then those values will be updated in microcontroller. The microcontroller i.e. Arduino nano compares the obtained values with the coded and predefined threshold values, if it is beyond the threshold value, it will generate an alert message and send it to the pre-set phone number through GSM [11]. The alert message is delivered to specified person in the form of SMS.

IV. FLOW DIAGRAM

Figure 2 shows the flow diagram of COVID-SMD. The process starts with the wearing of the device. Then device will keep on checking for any abnormal conditions continuously until it get any of them. Abnormal conditions may be high temperature, darkness, fall, device took off or pressing of panic button. Every time it sends an alert in form of SMS as soon as any of the conditions becomes true. In addition to the alert message it also activates the buzzer for the emergency situation.

V. MODULES OF THE PROTOTYPE

This Device has the following Modules:

1. High Temperature alert [5]
2. Fall detection [4]
3. Darkness alert
4. Device Took Off alert
5. Panic button [7]

5.1 High Temperature Alert Module

LM35 temperature sensor is used with sensitivity 10mV/°C. This module allows the caregiver to know if the temperature of the wearer increases beyond a certain threshold limit (here it is 40°C). Here in the block diagram shown in Figure 3, LM35 temperature sensor continuously measures the values as soon as the value crosses the limit, Arduino will send the alert using GSM to the defined phone number. It will also display alert "HIGH TEMPERATURE" on LCD. Figure 4 is the flow diagram of the module.

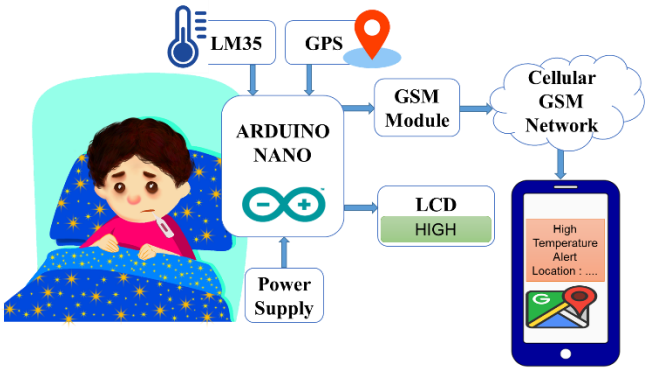

Figure 3 Block Diagram of High Temperture Alert Module

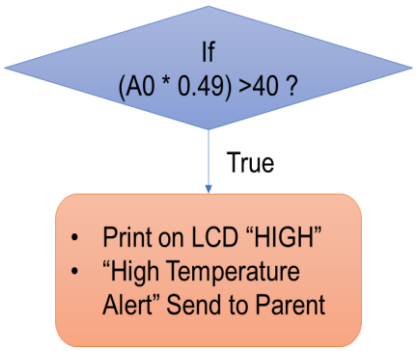

Figure 4 Flow Diagram of High Temperature alert Module

As Arduino analog pins can measure up-to +5 volts with pin resolution ranging from 0 to 1023.

$$5V = 1023 \text{ Bits (discrete values)} \quad -(1)$$

$$5000 \text{ mV} = 1023 \text{ Bits} \quad -(2)$$

But 10 mV = 10˚ C. So, 500 mV = 1023 bits.

Hence the value of 1 bit or one discrete value can be calculated as:

$$1 \text{ discrete value} = (500 / 1023) = 0.49 \quad -(3)$$

As the value of one discrete output is 0.49. So, if the analog output value of the sensor is stored in A0 then by multiplying it with 0.49 we could the equivalent temperature in degree Celsius as in equation (4).

$$A0 * 0.49 = \_\_\_\_\_ ^{\circ} C \quad -(4)$$

This feature of COVID-SMD will be very helpful for the current situation of COVID-19. As doctors and nurses can monitor temperature continuously without coming in contact with the positive patients of COVID-19.

5.2 Darkness Alert Module

There are two modules based on LDR. For both LDR is placed in series with a resistor i.e. in Voltage Divider form. When LDR is exposed to light resistance output voltage will change which will help us to know the darkness or exposure of light.

This module is used to detect the darkness which would be helpful if person is in dark by mistake for example child hides in drawer or child fall in the manhole or borewell. In this LDR will be placed on the front side of the device i.e. in the Light when there will be no light or darkness it will send SMS to the responsible person. When we obstruct the light falling on LDR or the light falling on LDR will decrease. The resistance of the LDR will increase.

A voltage divider consists of two resistances Rx and Ry connected in series across a supply Voltage Vin. The supply Voltage is divided between the two resistances to give an output Voltage Vo which is the Voltage across Ry i.e. the one connected near the ground terminal. This depends on the value of Ry relative to Rx whether output will increase or decrease as shown in following three cases:

1. If Ry is much smaller than Rx, Vo is small (i.e. low, almost 0V because most of the Voltage is across Rx)

2. If Ry is about the same as Rx, Vo is about half Vin (because the Voltage is shared about equally between two resistances Rx and Ry)

3. If Ry is much larger than Rx, Vo is large (i.e. high, almost Vin because most of the Voltage is across Ry).

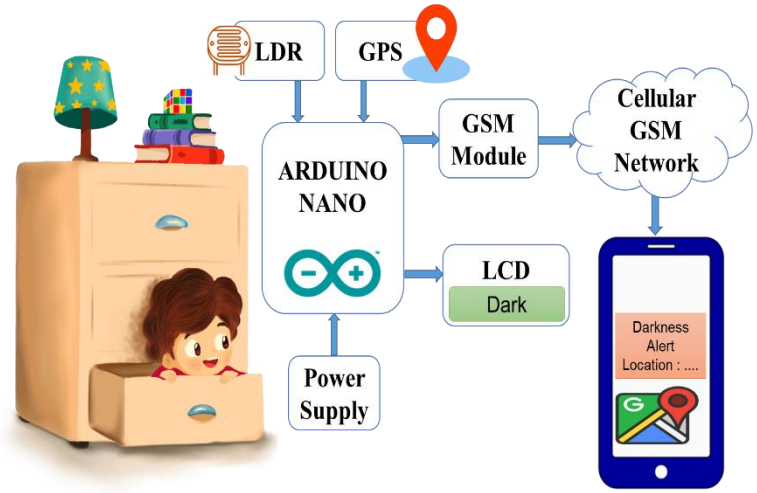

Figure 5 Block diagram of Darkness alert Module

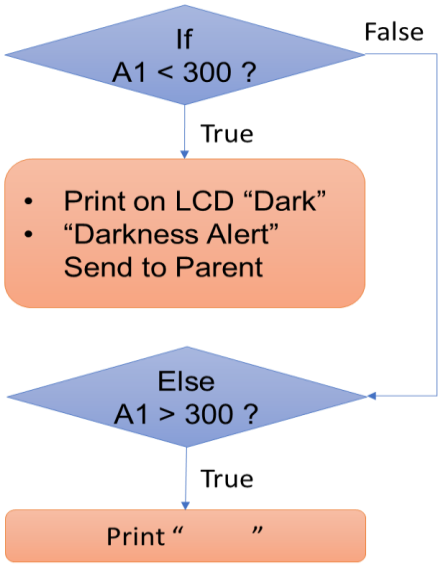

Figure 6 Flow diagram of Darkness Alert Module

Any of the configurations can be used one where the output voltage (Vout) increases with increase in light or the one where the output voltage decreases with increase in light. If the LDR is at the top i.e. near +Vin, Output voltage Vo will be high in bright light and low in the dark. If the LDR is at the bottom i.e. near 0V or ground , Vo will be low in bright light and high in the dark.

So, for the darkness alert module we have used first Configuration i.e. LDR is connected at top near voltage source. If light will decrease output voltage will decrease. It would then become less than Vin/2. Hence it will fall beyond the set value which would in turn alert us about darkness.

5.3 Device Removal Alert Module

Second module in which LDR is used is device took off alert module which will be used to know if the device has been removed or took off. Here LDR will be placed in Lower or back side of the device. LDR will placed in the dark, it will get exposure to light when removed. So, using this we would produce an alert for the caregiver that the device has been removed.

Further for the device removal alert module we have again chosen first Configuration i.e. LDR is connected at top near voltage source. If it gets exposed to light on removal or took off output voltage will increase i.e. will be high for bright light and will exceed beyond the predefined value, which would in turn create the device removal alert.

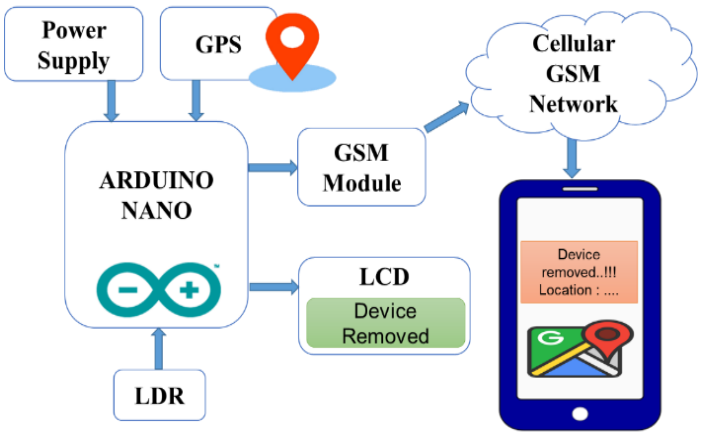

Figure 7 Block Diagram of Device Removal Alert Module

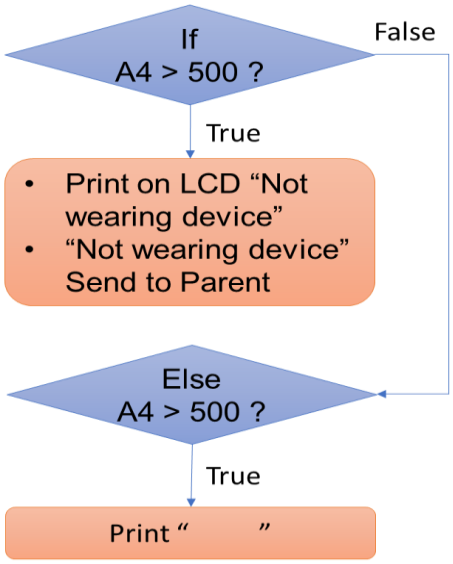

Figure 8 Flow diagram of Darkness Alert Module

5.4 Fall Alert Module

For a human, experiencing a fall unobserved by someone can be doubly dangerous. For instance, many aged individuals can undergo accidental falls due to dizziness or weakness or, in general, their slackened self-care and self-protective ability. Here as shown in the block diagram GY-61, 3 axis accelerometers are used for fall detection. It has a minimum full-scale range of ±3g.It measures static and dynamic forces. The axis which would be aligned with g-axis, that particular axis will have either +1 or -1 value depending on the its position with g-axis.

For example, if X-axis points downward i.e. -X will be positioned with g-axis, it would result in Xa=-1g, Ya =0g and Za=0g.So constant values will be set according to the position of module on the belt. If there will be change in axis, fall would be detected due to change in voltage.

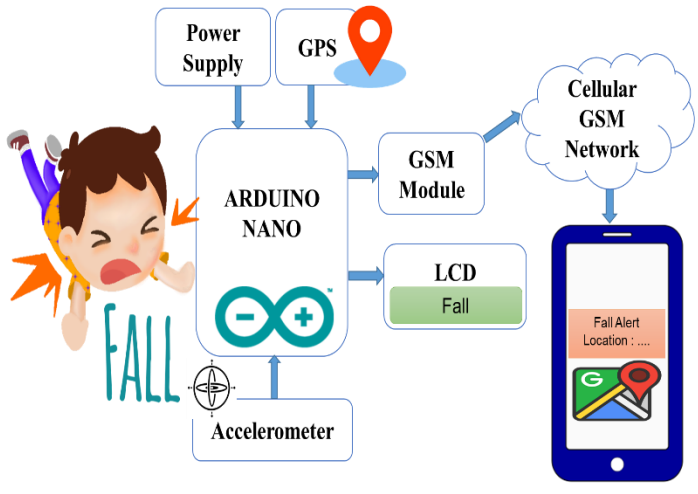

Figure 9 Block Diagram of Fall Alert Module

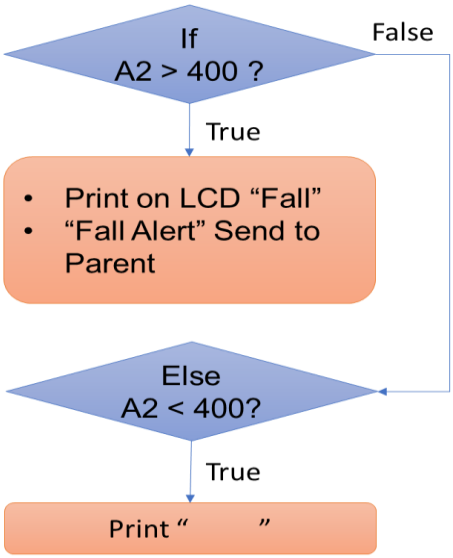

Figure 10 Flow Diagram of Fall alert Module

5.5 Emergency Alert Module with Buzzer

It is useful for medical emergencies for old age persons. It is helpful for dumb and blind people. A panic button alarm is an electronic device designed for alerting somebody in emergency situations where person feels danger or any needy situation. An Emergency Alarm Circuit is used for sending an emergency signal immediately to the person in nearby location to call for help. There can be any sudden condition of panic. The possible panic or emergency situation can be any, it cannot be restricted to few situations. Like it could be due to an intruder entering house or bad health issues. Situations are many for panicking and also vary from person to person.

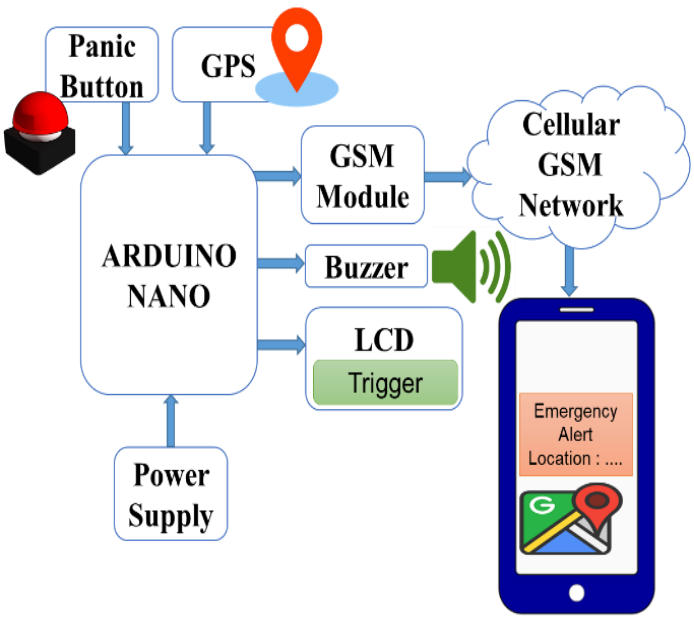

Figure 11 Block Diagram of Emergency Alert Module

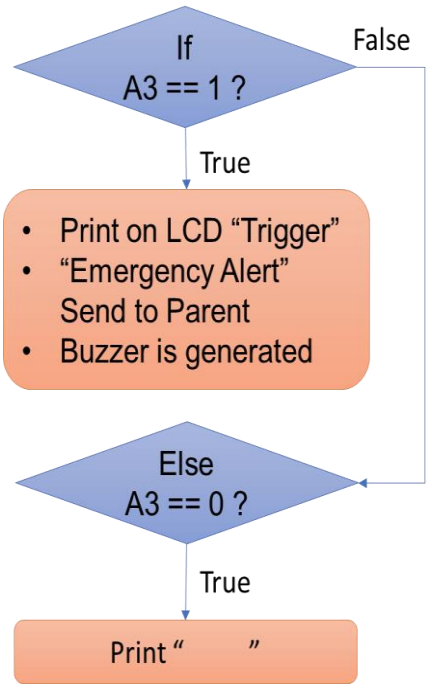

Figure 12 Flow Diagram of Emergency Alert Module

Here a simple block diagram and flow chart is shown in figures 11 and 12 respectively. When the button is pressed by the wearer, Arduino will get 1 or HIGH on the pin connected to the button. In turn Arduino will display an emergency alert on LCD and will also send the text message to the caregiver. It will also activate the Buzzer. If button is not pressed there will be no such activity.

VI. RESULTS

Here are images of the results achieved. The alert messages received are as following: (as shown in Figures) Along with these alert messages Latitude and Longitude of the wearer will also be given in SMS.

1. High Temperature Alert (Figure 13)
2. Not Wearing Device Alert (Figure 17)
3. Fall Alert (Figure 14)
4. Emergency Alert (Figure 17)
5. Darkness Alert (Figure 14)

Figure 13 High Temperature alert

Figure 14 Temperature Monitoring, Darkness alert and Fall Alert

Figure 15 Sending Alert Notification

Figure 17 Alert Sent Notification

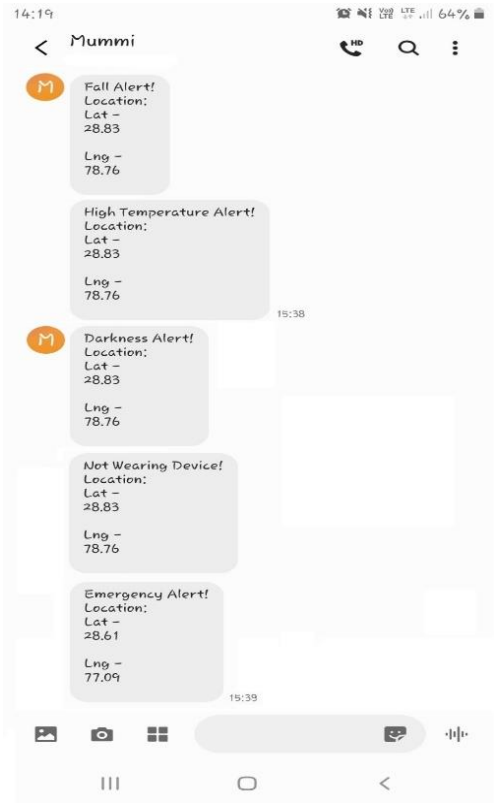

Figure 16 Screenshot of Received Alert Messages

VII. CONCLUSION

This device will not only be helpful for a child but it would be helping hand in our medical field also like for doctors, nurses, patients, handicapped and dumb. The accelerometer will give alert when no motion is detected which could be due to fainting or child has fallen or slept. Next comes Temperature sensor which would alert if the temperature of the wearer rises above the set value and then LDR would work as a monitoring of person wearing it, if they would be in dark alert would be sent. Another use of LDR is if someone removes the device it would get contacted the light which would create alert.

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