

Prototyping and Testing (DS3001): Final Report Indian Institute of Information Technology, Design & Manufacturing, Kancheepuram - 600127

Team-24: Compact Safety Device

Team Members:

- K SAI DINESH (CS20B1122)
- G KAVYA SRI (CS20B1126)
- K SATHWIK (EC20B1011)
- SAHITHI PATTEM (EC20B1116)
- S SAKET REDDY (ME20B1054)

Motivation:

Safety is becoming a major concern in India, especially for women and children. Also, the crime rate is on a spike in India. With increasing exposure of women in different fields, the amount of violence has also increased many fold due to this. When it comes to children, kidnapping cases are on a rise in India with over 101 thousand kidnapping and abduction cases in the year 2021 alone. So our objective is to:

1. Provide a compact device which can make calls and share our location with the emergency contacts.
2. Should protect the bearer against the assaulters through some self-defense mechanism.

Literature Survey:

Some of the existing technologies with this regard include the following:

- Self-defense gadgets like pepper spray, stun guns, taser guns, self defense keychains, hidden cameras, alarms, etc.
- Safety apps on smartphones which require us to unlock the phone and then operate the app on the phone.
- Simple GPS trackers which we can carry in our bags or pockets.

In this regard, we looked at some research papers which have worked in this direction:

- **Personal Safety Device Using GPS and GSM(2014)**

This paper proposed a wearable device that sends an alert message to the user's emergency contacts and a central monitoring system when the user presses a panic button. The device uses GPS and GSM technologies to provide the user's location.

- **Wearable Panic Button with GPS Location (2018)**

This study developed a small wearable device that sends a panic signal to a mobile app and emergency contacts. The device is equipped with GPS technology to provide the user's location information.

- **Compact Safety Device with GPS and Bluetooth (2019)**

This research proposed a compact safety device that uses GPS and Bluetooth to send location information and alert messages to emergency contacts. The device is small enough to be attached to a keychain or worn as a pendant.

Roadmap/Timeline for this project:

The following is the detailed timeline of work progress across all 12 weeks:

- **Week-1:**

Searching for the problem statement for the course project. Visited websites like Smart India Hackathon, Startup India, various hackathons conducted by Indian states and IIT's, etc. Shortlisted around 5 viable problem statements.

- **Week-2:**

Validating the above shortlisted problem statements after doing some market research and taking feedback from the professors. Had to do some more searching for a better problem statement.

- **Week-3:**

Finally selected the problem statement after a positive response from the professors and TA's. We tried looking at it in a different context to narrow down our future solution approach.

- **Week-4:**

Surveyed some of our family members, relatives and friends regarding this topic and acquired an understanding of what is really required in this regard.

- **Week-5:**
Conducted the Literature survey to search for various possible existing solutions and technologies. Pinpointing the shortcomings of these solutions and discussing how we can eliminate them using a different approach.
- **Week-6:**
Started sketching the initial prototype on paper before realizing the final product design. Encountered many problems w.r.t the compactness of the device. Finally decided on the first draft of the design. Started working on the CAD model.
- **Week-7:**
Attended the first design hackathon where we validated the changes in the idea and presented the CAD model to the professors and TA's. Considering the feedback, we had to change our approach to the problem.
- **Week-8:**
Started making the circuit design for the working of the device. Started looking for the components required for the working of the components by visiting websites like Arduino, etc. for looking at the specification charts for various boards and modules required for the prototype.
- **Week-9:**
Placed the order for the components on Amazon.com.
- **Week-10:**
Attended the second design hackathon where we submitted the Bill of Materials (BoM). Started assembling the components (soldering the circuits, checking for feedback in circuits, etc.). Also, asked the professors for any extra features to be included in the prototype for making it better.
- **Week-11:**
Writing the code for the functioning of the Arduino and uploaded it to the board. Also, dealt with a lot of issues w.r.t the circuit boards and the connections.
- **Week-12:**
Final testing of product in various working environments.

Roles and Responsibilities:

- **K SAI DINESH (CS20B1122):**

1. Wrote the code for the working of the Arduino and passing the controls to the GSM SIM800L module (for making calls and receiving messages) and NEO-6M GPS module (for GPS tracking of coordinates).
2. Helped with problem statement search in the initial couple of weeks.
3. Helped with the Literature Survey to some extent.
4. Gave suggestions to Saket with respect to the CAD model.

- **G KAVYA SRI (CS20B1126):**

1. Proposed the problem statement for the project.
2. Did the majority of the Literature Survey required for the project.
3. Ordered the required components on Amazon.
4. Monitored the overall progress of the prototype.

- **K. SATHWIK (EC20B1011) & SAHITHI PATTEM (EC20B1116):**

1. Designed the circuit design for the working of the product.
2. Assembled the circuits (performed soldering, checked for component working, placement on PCB, etc.)
3. Helped with problem statement search in the initial couple of weeks.
4. Collected the bills for the components and got the in-gate stamps for verification.

- **S. SAKET REDDY (ME20B1054):**

1. Designed the CAD model for the prototype & reiterated its designs.
2. Also did 3D printing of the above CAD model.
3. Helped Kavya in doing Literature survey.
4. Also, helped Sathwika and Sahithi with the circuit design of the prototype.

Methodology:

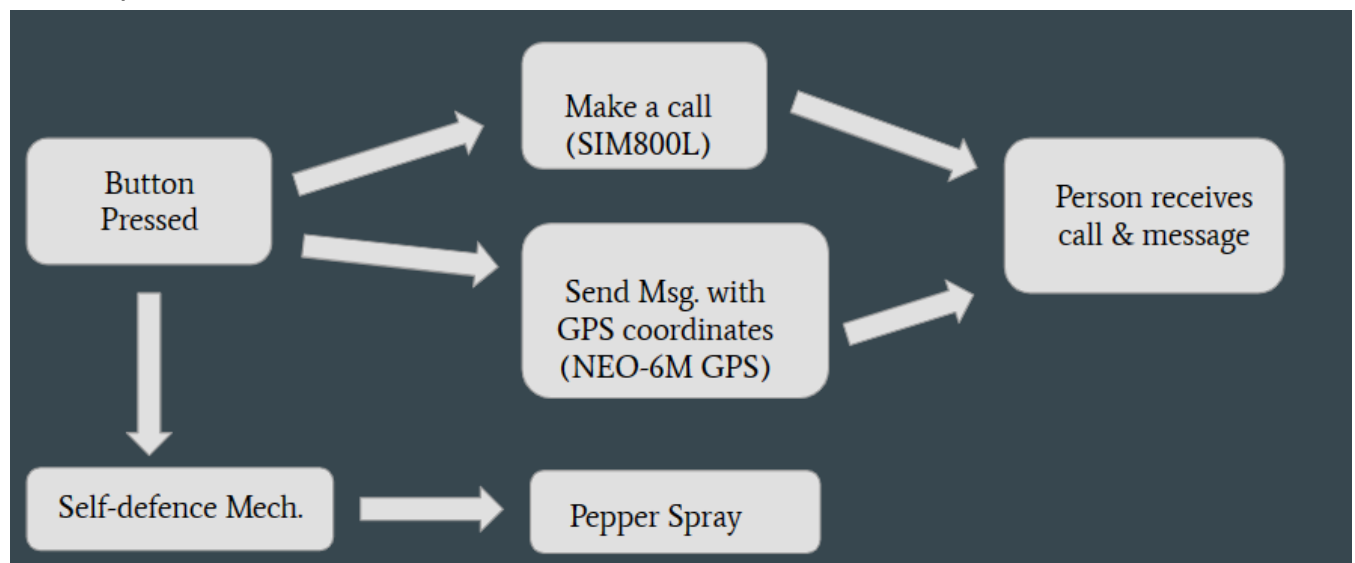
The problem with the existing products/technologies is the presence of a mobile network. Since it's a bigger problem to solve and also because it's out of the scope of this course, we assumed the presence of a mobile network. Another problem is that it

requires the possession of a mobile phone where you unlock the phone, open the app and press the SoS button, by which time it may be too late for the user to defend themselves. Another problem is the cost of the device, these compact devices usually cost the price of a smartphone, which in some aspects doesn't make sense.

So, our proposed solution goes like this:

1. We will have a compact device independent of any connection with the smartphone i.e., we don't require any smartphone for it's working.
2. We will provide a button on the device in case of emergency. This button makes a call and sends the message containing the google maps URL (for location tracking) to the registered phone number.
3. On top of this, we have integrated a self-defense gadget (pepper spray in this case) to defend against the assaulters in the meantime.
4. **"GSM SIM800L"** Module is responsible for making calls and sending SMS.
5. **"NEO-6M GPS"** Module is responsible for tracking the coordinate of our whereabouts using GPS.

A small process-flow chart will make this clear:



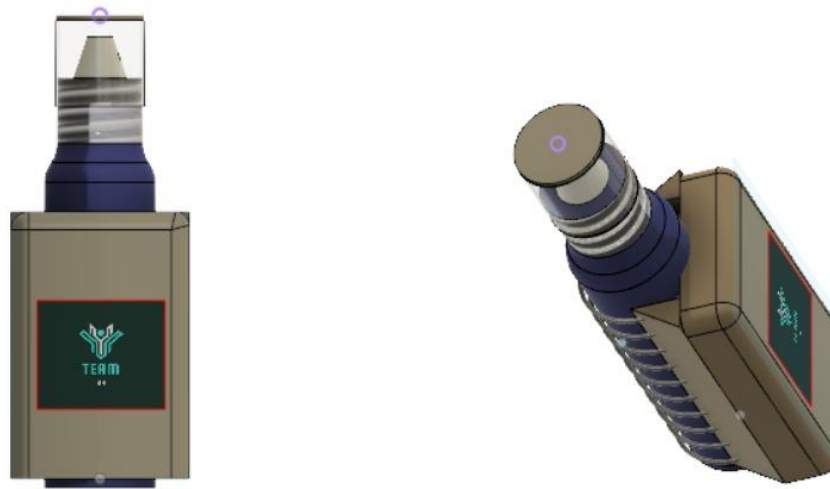
NOVELTY:

1. Doesn't require a smartphone separately.
2. Easily accessible because of its compactness and can fit into a pocket. Can be used by school-going children as smart phones aren't allowed in schools.
3. For women wearing saree, we have provided a hook for tucking it in.
4. Contains a self-defense gadget mounted on it, which is missing in many of the solutions proposed in research articles.

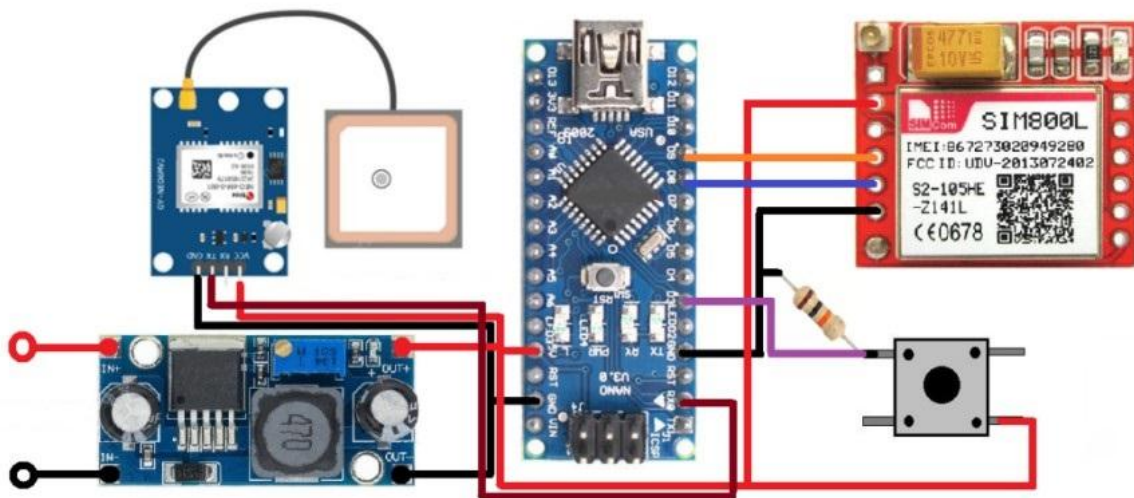
Bill of Materials:

Serial No.	Item Description	Price (in ₹)	Quantity	Total (in ₹)
1	LM2596S with SMD LED DC-DC Step-Down Power Supply	145	1	145
2	SIM800L GPRS GSM Module Micro SIM Card Core Board Quad-band TTL Serial Port	369	1	369
3	NEO-6M GPS Module	479	1	479
4	4-Pin Push button switch	12.25	4	49
5	NANO V3.0 Development Board	590	1	590
6	10K ohm 1/4 Watt Resistor	1.167	30	35
7	Zero PCB board	42	2	84
8	3.7v 600mah Lithium ion Lipo Lithium Polymer Battery	399	1	399
			Items(in ₹)	₹ 2,150
			Delivery(in ₹)	₹272
			Total(in ₹)	₹2422
			Promotion Applied(in ₹)	₹ 40
			Total Cost (in ₹)	₹2382

Images of the Product:



(The CAD Model)



(The Circuit Diagram)



(The Actual Product)

Scope:

Our solution is targeted for working women, college girls and school-going children who want to have an extra hand of safety when they are out of their homes. It can also be used by senior citizens in case of any health emergencies or accidents.

The user can expect this device to provide a quick alert to others in the event of an emergency, help women/children defend themselves against an attacker and provide a means for locating a person who may be lost or in danger.

Constraints:

The following are the constraints to the efficacy and working of the product:

- Presence of a Mobile Network.
- Response time of the concerned contacted people.
- Physical strength of the person to defend themselves.

- Potential dispossession of the device from the user.

Learning/Benefits:

1. A compact safety device with multiple functionalities is an effective way to ensure personal safety.
2. Including an alert message, GPS address, and the ability to make calls to relatives can provide quick and reliable notifications in case of an emergency.
3. The integration of shock generation, piezoelectricity, and pepper spray can increase the device's effectiveness as a deterrent against potential threats.
4. Prioritizing safety working and minimizing loss cost can improve the device's overall usability and accessibility.

Specific/General Takeaways:

1. The alert message feature should be designed to quickly notify authorities or emergency contacts in case of danger or emergency, and should be easily accessible by the user.
2. The GPS tracking system should be accurate and reliable, and should provide real-time location updates to emergency services or designated contacts.
3. The call feature should be user-friendly and easily accessible, and should allow the user to quickly and easily contact their designated contacts in case of emergency.
4. The shock generation feature should be designed to effectively deter potential attackers, while minimizing the risk of harm to the user.
5. Piezoelectricity can provide a reliable and sustainable power source for the device, reducing the need for external charging and increasing its usability.
6. The pepper spray integration should be designed to provide a safe and effective means of self-defense for the user, while minimizing the risk of accidental discharge or harm to the user.
7. Prioritizing safety working can ensure that the device is reliable, durable, and user-friendly, while minimizing the risk of malfunctions or defects.
8. Minimizing loss cost can increase the device's affordability and accessibility to a wider range of users, while maintaining its effectiveness and reliability as a personal safety device.

Future Scope & Next Steps:

The following aspects can be brought into the product in the near future:

1. Integrate the device with an app which connects to the nearest police station helpline to contact for help.
2. Make the device's working network independent.
3. Using VPS (Visual Positioning System) instead of GPS.
4. Integrate a piezoelectric shockwave generator with the device, which gives an electric shock when the assaulter tries to dispossess the user of the device.
5. Inbuilt memory storage of camera recording.

Conclusion:

Finally, we conclude our project by saying that this product can make a positive impact in contributing to the safety of women and children in general use cases. This device can help the women and children to feel more safe when they step outside of the house and give themselves a better chance of defending themselves against the assaulters. With improvements in technology, we can integrate stronger self-defense gadgets to this device and make it go network-less, to increase its effectiveness and thus perform better in these kinds of situations.

References/Citations:

- WOMEN SAFETY DEVICE BASED ON GPS & GSM (2020)
- E-defense-for-women-safety

—END OF REPORT—