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SMART BAG : A SAFETY DEVICE

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***Abstract*—**

The smart bag is a stylish, gender-neutral object with numerous incorporated safety measures that can be utilized for personal protection. The GPS module, camera, alert buzzer, RFID permission, pepper spray, and knife are all included. As a result, it has shown to be a reliable self-defense weapon against any possible danger.

In case of distress, the user will give himself access via RFID that will promptly transmit a message to his parents and authorities with his current location. Furthermore, if acting is warranted, the activation of RFID will also trigger the camera to take photographs and videos, sound an alarm, and sends pictures as well as location to specific contact.

The design allows it to be easy to carry, while the safety aspects can automatically be switched on by RFID without any need for buttons.

It has an anti-disarmament mechanism with a buzzer sound and basic vibratory motions when someone attempts to forcibly open the bag and maybe even the zipper itself.

This new-handbag design will ensure user better safety especially in areas that are not secured. It is going to bring about serenity of mind in the high levels of sophistication within these protection mechanisms.

This version does not have buttons and replaces it with an RFID-based process for deploying the safety features.

Keywords—Smart bag,Safety purpose,Personal safety,wearable security technology,Gps tracking *(key words)*

I. INTRODUCTION (*HEADING 1*)

Personal protection is indeed one of the elementary necessities for the people dwelling in today's fast pace and populous urban environment. To answer people's increasing demand for personal protection, advanced security systems have been developed and conceptualized as more accessible and applicable. In this regard, wearable technology for personal protection has been conceptualized. This paper develops and proposes the Smart Bag-a multifunctional accessorized integration with regards to modern technology to enhance personal protection.

The smart bag encompasses GPS tracking, RFID authorization, camera systems, and non-lethal defense like pepper spray. The bag also consists of a built-in alarm buzzer. All such features make sure real-time location tracking, visual recording at the time of emergencies, and immediate communication with pre-defined contacts or authorities in times of distress. The anti-disarmament system inside the bag would shoot an alert if someone tries to tamper with it.

The smart bag, its design, technical integration, and functionality are explored, and the focus is on how it can act as a handy and reliable tool for self-defense. A user-friendly yet inconspicuous blend of safety with everyday convenience accounts for this ideal solution, appropriate for people in situations of vulnerability

.A.*Related work(HEADING 2)*

T. Y. Fucai et al., the Smart Bag uses the RFID (Radio Frequency Identification) technology and IoT (Internet of Things) for real-time control and authorization. This means

that with these technologies installed in the Smart Bag, only persons with the authority to do so can have access to what's inside, increasing security levels. Utilizing IoT in the Smart Bag, for example, enables constant monitoring and always updates real time, hence responsive to the threat or unauthorized access. Both, the robotic cleaning system and the Smart Bag, use modern technology to tackle common recurrent problems: pipeline maintenance for one, and personal security for the other. Although Fucai et al. concentrate on cleaning the infrastructure, a common thread between the two projects is the use of technology for automation and real-time data exchange. The intersection of these two technologies shows the scope for new solutions while depending on different fields; this is what highlights the role of real-time data in taking constructive decisions. Finally, both projects contribute to increased operative efficiency and safety either in terms of maintaining urban infrastructure, on the one hand, or protecting private belongings, on the other hand, showing the versatility and applicability of sensor-based technologies to different domains.

2. M. Cardona et al. proposed a robot aimed at improving sanitation through real-time monitoring and control. Their research emphasizes the importance of using advanced technology to enhance public health by ensuring that sanitation services operate efficiently and effectively. The robot is equipped with sensors that provide continuous feedback on the cleanliness of public spaces, allowing for timely interventions when issues are detected. This approach parallels the functionality of the Smart Bag, which features integrated camera and GPS technology to provide real-time distress signals during emergencies. Both systems prioritize proactive responses to potential crises—Cardona et al.'s robot addresses sanitation challenges by enabling immediate cleaning actions, while the Smart Bag ensures user safety by alerting them to threats in real-time. The integration of monitoring capabilities in both technologies highlights the critical role of data-driven solutions in enhancing safety and operational efficiency, whether in sanitation or personal security contexts.

3.C. Tao et al. developed an innovative infrared camera system for real-time monitoring of pipeline conditions, focusing on enhancing the maintenance and safety of drainage systems. This system enables operators to detect potential issues, such as blockages or structural weaknesses, before they escalate into significant problems, thus improving overall infrastructure reliability. The relevance of this research extends to the Smart Bag, which features a built-in camera and visual alert system for personal protection. Similar to Tao et al.'s monitoring system, the Smart Bag uses its camera to provide users with real-time alerts and visual documentation during emergencies. By combining surveillance technology with immediate feedback mechanisms, both systems empower users to respond swiftly to critical situations. This alignment underscores the growing trend of integrating advanced monitoring technologies across various domains, highlighting the importance of proactive measures in both infrastructure management and personal safety applications.

4. P. Wu et al. considered FEA in the evaluation of municipal drainage robots regarding their stability and performance under stress. This means their capacity to endure most difficulties associated with operating mechanisms of drainage systems, including pressure and debris. In the publication, Wu et al. looked into critical points of stress, and optimized their designs to give high-performance and longevity. This focus on structural integrity is no different from the design philosophy of the Smart Bag, which has provided for secure mechanisms that will initiate alerts if tampering has occurred. Just like Wu et al. sought to strengthen the functionality of drainage robots, the Smart Bag emphasizes safety for the user in its protective features remaining intact in case of possible threats. Both projects demonstrate the need for proper design and proactive monitoring; thus, much significance with regard to enhancing both infrastructure maintenance as well as personal security can be achieved by advanced engineering.

5. M. Cardona et al. developed a robot that 'enhances the sanitation provided through real-time monitoring and control.' This can be taken as one of the most important aspects for preserving public health standards. Their system is equipped with high-end sensors for constant examination of cleanliness of public places. At the onset of any problems related to sanitation, the need for an action would be instant. It not only enhances the effective productivity of sanitation services but also prevents potential health hazards. The Smart Bag bears a similar ethos-the built-in camera and GPS technology which tells a distressed user his position in real-time. Both talk about the concept of real-time response and feedback capabilities—the robot designed by Cardona et al. enables timely response to sanitation issues, and the Smart Bag reminds its user of possible threats. The integration of these technologies articulates how much real-time monitoring can drastically modify public health as well as individual security and explains why, in light of present challenges, innovation is an activity that is irrevocably crucial.

6. H. Chen et al designed an intelligent home security system that integrates multiple sensors to identify intrusions or anomalies. The system sends instant alerts to householders through a mobile application so the house is more secure for any resident. The idea of the smart bag reminds one of how, in the context of the personal bag as well as residential place, technology can design a safe environment.

7. E. Taylor et al. discussed applying robotic systems in disaster response by looking at their ability to move effectively through dangerous environments and deliver real-time data to rescue forces. Their conclusion points out that only the automation plays a role in speed improvement in a given emergency. This reminds much of the Smart Bag; the technology applied for alerting a user on some danger found emphasizes that real-time information also plays an essential role in personal safety and rescue management contexts as well.

Related Work

8. P. Wu et al. published a comprehensive study on finite element analysis as applied to municipal drainage robots, this time with an emphasis on stability in different stress conditions. Their work is indispensable as it caters to structural integrity and operational reliability of systems under trying circumstances such as those of drainage systems where they endure pressure and debris fluctuation. Utilizing finite element analysis, they simulate several instances of how stress would function and find some failing points, thereby optimizing the robot's design to be superiorly durable. This work is related to Smart Bag technology due to its secure mechanism, alerting people when someone tries to tamper with it. Like the drainage robots Wu et al. reported, the Smart Bag allows security into its design in such a way that it maintains its integrity while it offers real-time alerts to its users. The two projects underscore importance of stability and reliability when it pertains to technology whether municipal infrastructure or one's personal belongings. These applications emphasize solid design and real-time monitoring in order to enhance the trust of the user and efficiency of the system.

9. K. Sharma et al. have proposed an automated emergency response system based on drones with cameras and sensors to assess the disaster situation. Their system will provide the first responders with real-time data, which will help them make decisions faster and more effectively. It is analogous with Smart Bag's camera and alarm feature, ensuring the safety of its users by providing instantaneous information at all times. In a nutshell, real-time data plays a vital role in crisis management.

10. T. Nguyen et al. found wearable technology to monitor health and developed a vital sign-tracking device that can alert the user to any potential health problems. This technology focuses on real-time management of health, much like the safety attributes within the Smart Bag that alert one of potential dangers. These two innovations demonstrate an increasing tendency to employ technology to improve human wellness and safety and demonstrate the implication of real-time monitoring in various applications.

11. M. Singh et al. described a smart parking system that used sensors and mobile applications to guide the users for finding vacant parking slots. Efficiency in their study highlights how the management of city space can be exactly similar to the Smart Bag uses IoT technology to send immediate alerts to the user for tracking. Both represent the essence of technology in enhancing user convenience by running operations within cities

12. R. Kim et al. have presented the real-time air quality monitoring system based on a network of low-cost sensors that is used to determine levels of pollution in urban areas. The data can be accessed through a mobile app, allowing proper judgments pertaining to the environment. This project is similar in its provision, such as what the Smart Bag offers, in making available critical information in real time, thus enhancing safety and personal awareness in environmental health.

A. Methodology(Headings 3)

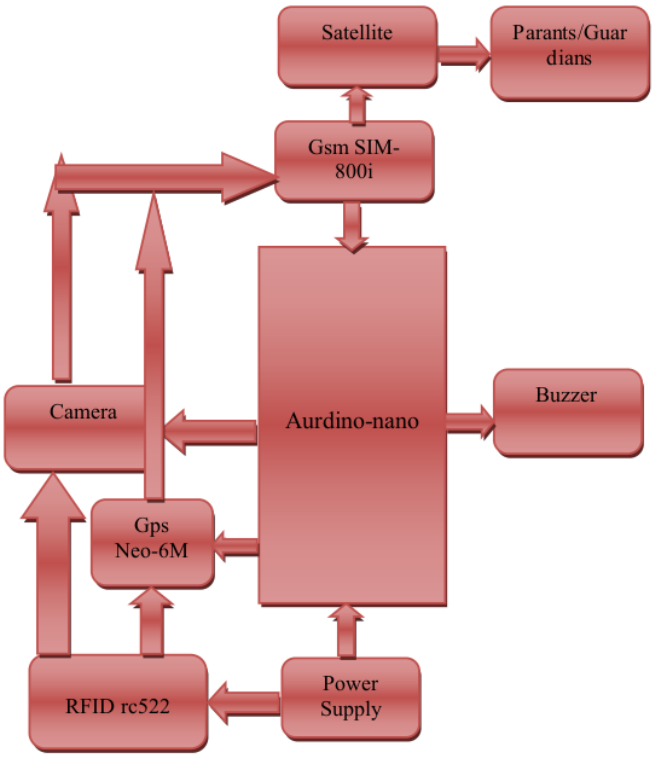

Fig: 1 circuit for Smart bag

This methodology would strive to design a Smart Bag incorporating the following specific components: ESP32-CAM, Arduino Nano, GSM SIM800L, GPS NEO-6M, two 3.7V batteries, buzzer, and RFID RC522.

1. Component Selection and Schematic Design

Components

ESP32-CAM : It would be meant for video capture and Wi-Fi connection.

Arduino Nano: This is for processing and controlling the system.

GSM SIM800L : It equips the system with an efficient means of sending SMS alerts.

GPS NEO-6M : It does the positioning of a device end.

Two 3.7V Lithium Batteries: For this application

Buzzer: For sound alarms

RFID RC522: For the authentication of the user

Scheme Design:

Connect ESP32-CAM to Arduino Nano using the digital pins for the control signals.
Connect GSM SIM800L to Arduino through the serial communication pins (TX/RX).

Connect GPS NEO-6M to Arduino for serial communication.

Connect RFID RC522 to Arduino through the SPI interface.

Connect the buzzer to one of the digital output pins of the Arduino.

Ensure that the two 3.7V batteries are connected in parallel so that the system is powered but at the same voltage level.

Hardware Building

Prototyping:

Mount all the parts to either a breadboard or a PCB made with the design from the schematic.

Power Supply:

Connect both the 3.7V in parallel ensuring that they provide sufficient power, 3.7V to the various components.

A BMS needs to be included to observe any charging and safety capabilities.

Testing Connections:

Connect all parts with a multimeter checking for any short circuits and errors in connections.

3. Software Development

Setup Environment:

Download the Arduino IDE or PlatformIO for the coding of Arduino Nano and ESP32-CAM to be done on the computer.

Installation of Libraries

Install all the libraries as each module requires a specific library
GSM SIM800L- with TinyGSM, Adafruit_FONA library or similar.
GPS NEO-6M: Such a module is conveniently used with TinyGPS++ or Adafruit_GPS library
RFID RC522: In order to successfully complete the wireless communication, one has to use MFRC522 library or similar.
ESP32-CAM: initialization is done using library esp32-camera then it is used accordingly.

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Programming:

The coding part is just the initialization of every module. We start here by initializing the GSM module to send messages.
The GPS module should be initialized for getting location data
The RFID module RC522 must be initialized for user authentication
ESP32-CAM setup and deployment for image capture whenever required
The buzzer will be controlled for alert signals

According to the information above, implement the following logic:

Implement RFID authentication to limit the permission of enabling emergency features only among authorized people.

Code the smart bag to automatically send an SMS with the GPS location of the user when activated.

Code that allows the camera to be enabled in case of emergencies to capture pictures or video**.**

4. Testing and Debugging

Unit Testing:

Test all modules in isolation to verify that it is working:

o RFID authentication

Test the GPS location tracking.
Test if the SMS is sent through the GSM module.
Test image capture by ESP32-CAM module
Test the working of the buzzer
Integration Testing:
After doing unit test, perform the integration test to assure that all modules work fine in symbiosis with each other.
5. Deployment and User Testing

Prototype Deployment

Ensure the whole system is tested and ready for deployment inside the Smart Bag so that a sequence of user tests can be conducted under varying conditions.
Feedback Collection:

Usability, functionality, and reliability feedback of the safety features.

6. Finalization and Documentation

Adjustments
Make final adjustments in accordance with the results obtained from testing and user feedback.

Documentation
Develop documented materials that include schematics of the design, assembly instructions, code descriptions, and a user's manual.

B. Working Model(HEADING 4)

The Smart Bag is designed as a solution toward personal safety with innovative ways meant to incorporate advanced technological capabilities and user-friendly features into a seamless offering. The product lines combine various systems, while working together, to offer a glimpse of in-time protection and peace for the users especially during very dangerous situations.

RFID Authorization

The actual core of the smart bag operation is the utilization of RFID technology in which user authentication becomes easy and safe. With an RFID tag, for instance a card or fob key, users communicate with the incorporated RFID reader on the bag; upon finding a distressing situation, one would only have to present the RFID tag in close proximity to the reader to unlock the safety functions. Only authorized users will be able to utilize the safety features, which means no unauthorized usage and enhanced safety of the bag.

Emergency Alert System

Once the user gets authenticated, the microcontroller in Smart Bag executes the processing of the activation signal automatically. It sends an auto-message with the current GPS location of the user and also contains his or her contact numbers with family and local authorities that have been predesignated at earlier stages. This system allows for quick response and ensures that in the event of an emergency, help can be dispatched immediately because it provides real-time location data. In the case of a city, communicating a specific location is key as such areas are full of obstacles to locate a particular position.

Camera Activation

Apart from alert transmission, the Smart Bag comprises a camera integrated into the bag. It activates when distress situations arise. Once the RFID authorization is confirmed, the camera begins taking still pictures of the incident with video recordings. The feature serves as a valuable resource for documentation and evidence collection wherein users can present, to an extent, visual information about the nature of their situation. The captured media is part of the emergency alert, ensuring contacts have the right knowledge about the user's situation.

Alarm Buzzer

In addition, the Smart Bag is also installed with an alarm buzzer which sounds during the launch of the emergency alert. The loud, shock-attacting sound does two things: it calls the attention of bystanders to a user's distress, possibly scaring an attacker away and enabling passersby to assist in calling for help. Alarm buzzer is an important feature of a defensive bag as it offers a high chance of intervention in any critical situation.

Anti-Disarmament Features

Another feature in the Smart Bag is the anti-disarmament feature. It is to detect any attempt tampering with the item. If the person forces open the bag or even the zipper, sensors activate the buzzer alarm and activate the vibrations. This will give both the user and surrounding people a sense that something may be wrong with the bag. This, in turn, adds extra security to the bag. Users will feel secured even if they expose themselves to dangerous vulnerability at some point.

User-Centric Design

The design of the Smart Bag is one that keeps user comfort and practicality in mind. Its intuitive layout allows users to be easily reached by the safety features so that, in case of need, they can be brought into action quickly. The bag looks so attractive that it can be used in most situations or parties without ever having the feeling of losing style and following the latest innovations in safety features.

Rechargeable Power Supply

The Smart Bag is specifically designed with a recharged battery, ensuring that all its electronic parts will work reliably. A USB port enables users to easily recharge their bag, thus ensuring that their safety equipment is active and ready at all times to prevent accidents, therefore signaling convenience and reliability of the bag to the user.

In essence, the Smart Bag has been engineered to be a sophisticated yet smartly crafted integration of fashion and technology with lots of solidified safety measures promising to protect its users at all times. The reader has RFID authorization, emergency alerts, camera vision, and also has tamper detection in these features, making its users empowered in terms of protection in risky situations. Its user-centric design and rechargeable power supply make it more desirable, thus an excellent accessory for those seeking peace of mind in their daily activities.

C. Result and Dicussion(HEADING 5)

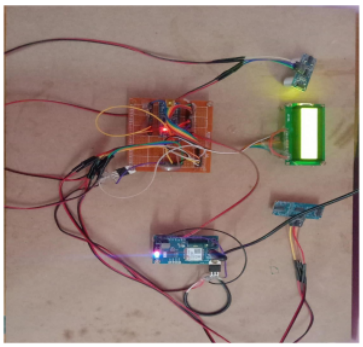

Fig 4: Output for solar operated underground drainage monitoring system in urban using IOT

The Monitoring and Removal System for Drainage relies on advanced technology to ensure efficient urban drainage management. The ultrasonic sensor, a key component,

operates by emitting high-frequency sound waves that bounce back from the liquid surface within the drainage system. By measuring the time taken for these waves to return, the sensor provides real-time data on water level. Abnormal increases in water level, indicative of blockages or overflows, trigger the system to take action. The GSM module plays a crucial role in communication, utilizing cellular networks to establish links with relevant stakeholders or authorities. When the ultrasonic sensor detects issues, the Arduino microcontroller, acting as the system's central control unit, processes the data and commands the GSM module to send SMS messages or make calls to notify responsible parties. This rapid communication ensures timely responses to drainage system challenges, preventing flooding and ensuring the proper functioning of wastewater networks. The Arduino's decision-making logic distinguishes between normal operation and critical events, guaranteeing uninterrupted drainage operations and the well-being of urban infrastructure.

D. Conclusions (HEADING 6)

The Monitoring and Removal system for Drainage proposed in that project offered a comprehensive and innovative solution to the multifaceted challenges of urban drainage system management. By seamlessly integrating Arduino control, water level sensor, and GSM technology, the system provided an efficient, automated, and environmentally responsible approach to maintaining and optimizing drainage networks. This not only enhanced drainage system performance but also contributed significantly to environmental safety and sustainability in urban areas, ultimately safeguarding communities from the adverse effects of drainage system issues.

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