ISSN: 2278-4632
Vol-12 Issue-01 No.01: 2022

A NOVEL APPROACH TO PROVIDE SECURITY FOR WOMEN USING SMART DEVICE

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ABSTRACT

In today's world, there are a lot of obstacles that make women feel unsafe. They must persevere through a wide range of challenges and demonstrate their worth at every turning point. The government has therefore established rules and regulations for the protection of its citizens. There are already quite a few security systems in place, but there has been a rise in the demand for cutting-edge smart security systems. The implementation of an intelligent security system for women is one solution to this type of problem.

This paper details a secure electronic system for women that makes use of an Arduino controller and various sensors, including a temperature LM35 sensor, a flex sensor, a MEMS accelerometer, a pulse rate sensor, and a sound sensor. This project makes use of a buzzer, LCD, GSM, and GPS. When a woman is in danger, the device detects her heart rate, changes in temperature, and motion using a flex sensor and MEMS accelerometer, and it also listens for her voice using a sound sensor. When the sensor detects movement beyond a certain threshold, the device is triggered and the victim's location is tracked via the built-in GPS. The victim's location is transmitted to the emergency contact via the GSM module.

Key Words: Security of Women, Arduino microcontrollers, a Flex sensor, a MEMS accelerometer, a GPS module, and a GSM module.

I.INTRODUCTION

Everyone's top priority in the modern world is the ability to feel secure. The most efficient method for doing so is via technological means. This is why it is important to create a project like this that can save lives and keep people safe in times of crisis. One goal of this work is to create a security system whose sole function is to make women feel safe in dangerous social situations. With the help of modern electronics like a GPS receiver, GSM, pulse rate sensor, flex sensor, MEMS accelerometer, and body temperature sensor, we can create a system that can detect a person's location and health condition and take appropriate action. A variety of sensors can be used to track where women are at all times during emergencies to protect them from abuse. It is possible to detect the woman's abnormal movement while she is being victimised because the victim's heart rate is typically higher in such situations.

II. CURRENT INFRASTRUCTURES

The victim in a security system targeting women and children [1] must press an emergency button, but in a real-life situation, that might not be possible. The kid can't just send his or her location using the Smart Phone by themselves. The A parent must initiate communication with the child's device in order to learn the child's whereabouts.

Friends must first be registered in the "Mobile Tracking Application for Locating Friends" friends group in order to use the mobile tracking application

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[2]. Both sides need access to mobile phones in order to monitor their companions.

Cost, signal interferences, and the access of invalid and unauthenticated users all pose problems for an Intelligent System based on RFID and GPS Technologies for Women Safety[3].

The primary shortcoming of these programmes and services is that the victim must initiate the first step [4], which is rarely the case in these kinds of situations. That's why it's crucial to prioritise developing an autonomous solution that can adapt to whatever challenges it faces.

Ringing a buzzer and transmitting the victim's location to the nearest police station is the new method presented in this paper for providing safety for women and children.

III. IMPROVED SYSTEM DESIGN

As can be seen in Fig 1, the proposed system's architecture is centred around an Arduino controller [5]. As the primary input and it receives signals from the sensors; the sensors, in turn, receive input from a person who is threatened, in danger, or experiencing something out of the ordinary.

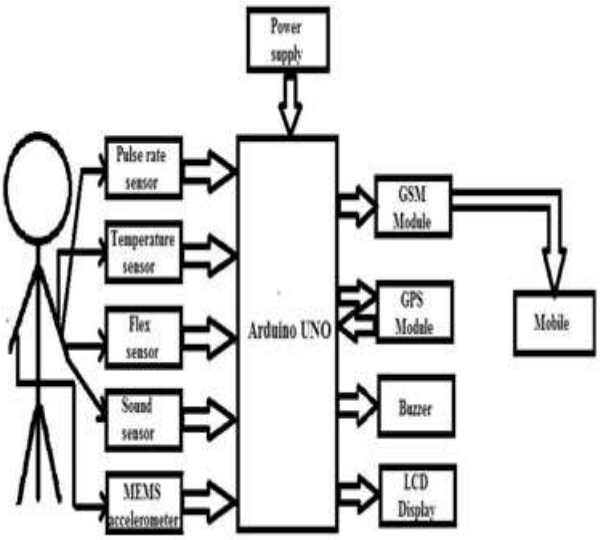

Figure 1: The Conceptual Framework for the Suggested System

Various sensors such as an LM35 temperature sensor, MEMS accelerometer, heart rate sensor, flex sensor, and sound sensor are described in the architecture. In this project, an LCD 162 display shows the women's (victim's) physical characteristics in a dangerous situation, a buzzer sounds an alarm, GSM sends a text message to the victim's designated contact number, and GPS pinpoints her location (women).

IV. THE WORKING CONCEPT

The idea is to have sensors in contact with women who are in a potentially dangerous situation; once the sensor detects a signal, it will send an electrical signal to a controller, representing data about the women's bodies. Each sensor's output parameters are generated by the Arduino and displayed on the LCD screen. The Arduino receives the signal from the sensor as an analogue input signal.

The proposed system makes use of a number of different sensors, including a flex sensor, temperature sensor, MEMS accelerometer, sound sensor, and pulse rate sensor. Each sensor is designed to pick up [7] indications of a woman in an abnormal situation. When the values of four out of five sensors exceed the threshold limit, the buzzer is activated, indicating that the women is in danger, as determined by victim condition.

For this reason, the GPS first sends its location data to the Arduino, which in turn sends it on to the GSM. After all of this, the registered contact number receives an alert message saying "I am in danger" along with the coordinates of where the danger is occurring. With the victim's location tracked via GPS and a message detailing that location sent via GSM 800L to the appropriate contacts after a delay of 10 seconds, the sensor and buzzer can be used to alert authorities to an emergency situation.

V. THE HARDWARE DESCRIPTION

The Arduino Uno is a board that uses the ATmega328 as its microcontroller. It has a USB port, a

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power jack, an ICSP header, a reset button, and 14 digital I/O pins (6 of which can be used as PWM outputs). It also has a 16 MHz ceramic resonator. To get started, just plug in the included USB cable to a computer or use the included AC-to-DC adapter or battery.

The Arduino has 28 pins, 20 of which are input/output (I/O) pins, making it ideal for interfacing with sensors. In total, there are 14 digital and 6 analogue pins. The analogue pins of Arduino are used to connect each sensor to the system. To connect to the sensors, you'll need to use Port B's analogue pins AO, A1, A2, A3, A4, and A5. Here, the data lines of each LCD display are connected to the digital pins (2, 3, 4, 5, 7,6,7,8) found on Arduino's Port C. Through its USB connection, Arduino receives its power supply of 5v. The buzzer is wired to Arduino's 13th output pin.

Find out what the project's final results will be. Arduino interfaces with GSM and GPS, the project's primary components. As a result, in this setup, Arduino is used exclusively to implement the safety system.

Buzzer : A ceramic-based piezo-electric sounder, such as a Sonalert, that emits a high-pitched tone is now the preferred method of alerting people. These were typically connected to "driver" circuits that modulated the sound's frequency or on/off pattern.

Global positioning system (GPS), depicted in Fig. 2 below, is a navigation and precise positioning tool that determines a user's precise location on Earth in terms of longitude and latitude by measuring the time it takes for signals sent from a constellation of satellites to reach a receiver on the ground [8].

Figure 2: The GPS Module

There are 24 MEO (Medium-Earth-Orbit) satellites that orbit the Earth continuously, transmitting their locations every second from six different orbits roughly 12,500 miles above the surface. It takes in location data and sends it on to an Arduino. After receiving the GPS signal, the Arduino can proceed with its intended tasks.

GSM (Global System for Mobile) Module: International Mobile Telecommunications System (GSM) In order to use GPRS for sending and receiving text messages, a SIM card must be installed in the mobile device. GSM SIM card numbers are stored in the database. Control unit data is transmitted to the base unit via GSM. For our needs, GSM 800A, which uses the 900MHz frequency, will do just fine. It operates on an uplink frequency range of 890–915 MHz and a downlink frequency range of 935–960 MHz. It is clear that GSM benefits from the features of both FDMA and TDMA. Channel spacing is 200 kilohertz, and 124 carriers are produced in a 25 MHz bandwidth (FDMA). There are eight time slots (TDMA) for each carrier [9]. GSM 800L provides access to 992.02 speech channels at any given time.

Temp Sensor : Using a variety of temperature sensors, we can determine the internal temperature of the body. One such device is the LM35, a set of precision integrated circuit temperature sensors whose voltage output is directly proportional to the temperature in degrees Celsius. It has a linear operation range of +/- 10.0mV/°C and an accuracy of 0.5°C. A rescue module can be activated when there is a sudden and severe drop in core body temperature [10].

In Fig.3, a resistive flex sensor is shown being used to measure bending or flexing with minimal effort. Due to their portability, durability, accuracy of measurement, and low power consumption, the sensors have many potential applications. We think about how resistive flex sensors could be used to track physical

ISSN: 2278-4632
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activity [11] and in the creation of gesture-controlled interfaces and devices.

Figure 3 : The Flex Sensor

The Mems Accelerometer 6 is an electromechanical device for measuring acceleration and the force causing it (see fig. 4.8). There are currently a plethora of accelerometers to choose from. In part because of its portability and strength as a sensor, they are currently being developed for use in multi-axis sensing.

Capacitive MEMS accelerometers are among the most popular. Capacitive MEMS accelerometers are state-of-the-art due to their extreme precision even at elevated temperatures and their high sensitivity. As the device relies solely on the capacitive value that results from the change in distance between the plates, it is insensitive to the underlying materials. If two parallel plates are separated by a distance d, and the permittivity of the material separating them is E, then the capacitance produced can be written as

$$C0= \epsilon 0. \epsilon A/d = \epsilon A/d$$

Modifying the values of, A, or d will yield information about the resulting capacitance change, which will be useful in understanding how the MEMS transducer functions. Accelerometer readings are highly sensitive to variations in either d or A.

A plug-and-play heart rate sensor for Arduino is shown in Fig. 7's Pulse Sensor. Users who want to easily incorporate real-time heart-rate data into their projects [8] include students, artists, athletes, makers, and game & mobile developers. You can get accurate pulse readings quickly and easily thanks to the integration of an optical heart rate sensor with an amplification and noise cancellation circuit. It's ideal for portable uses because of its low power consumption; just 4mA is required at 5V.

The Pulse Sensor can be used to read heart rate by simply clipping it to an earlobe or fingertip and plugging it into a 3 or 5 Volt Arduino.

Sound Sensor: The sound sensor module depicted in Fig. 5 is commonly used to measure sound volume[12].

Fig.4: A Pulse Rate Detector

The security, switch, and monitoring industries can all benefit from this module. The precision can be changed quickly and easily to suit the user's needs. It is comprised of a microphone, amplifier, peak detector, and buffer. The sensor sends a voltage-based signal of sound detection to a microcontroller, which then processes the signal.

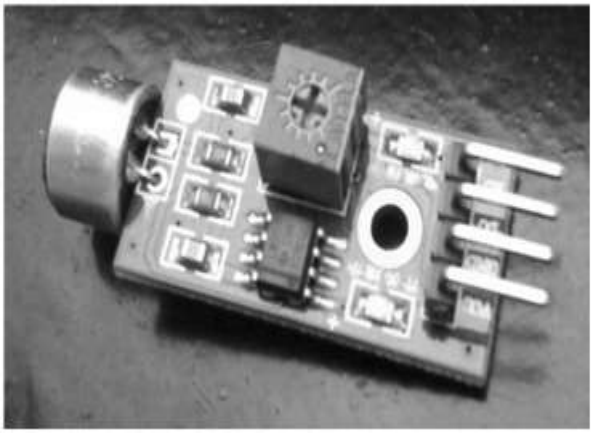

Fig 5: A Sound Detector

CODE FOR ARDUINOS

Here, we use the Arduino IDE (Integrated Development Environment) on a computer to draught, load, and edit sketches (what Arduino calls programmes).

The Arduino Software (IDE) can be used to write code for the Mega 2560 board. The Mega 2560's ATmega2560 microcontroller has a boot loader already

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installed, so you won't need an external hardware programmer to install new programmes. Authentic STK500 protocol is used for communication (reference, C header files). The ICSP (In-Circuit Serial Programming) header allows the microcontroller to be programmed without first loading the boot loader and using Arduino ISP. You can find the firmware source code for the ATmega16U2 (or 8U2 in the rev1 and rev2 boards) in the Arduino repository.

By leveraging this feature, the Arduino Software (IDE) enables users to easily upload code by having them press a single button. This allows for a shorter bootloader timeout by synchronising the DTR drop with the beginning of the upload. The ramifications of this setup expand further. If you connect the Mega 2560 board to a Mac or Linux computer, it will reset every time you make a software connection to it (via USB).

CONSTRUCTION OF THE INTENDED SYSTEM

The process flow for implementing the proposed system is depicted in Fig. 6.

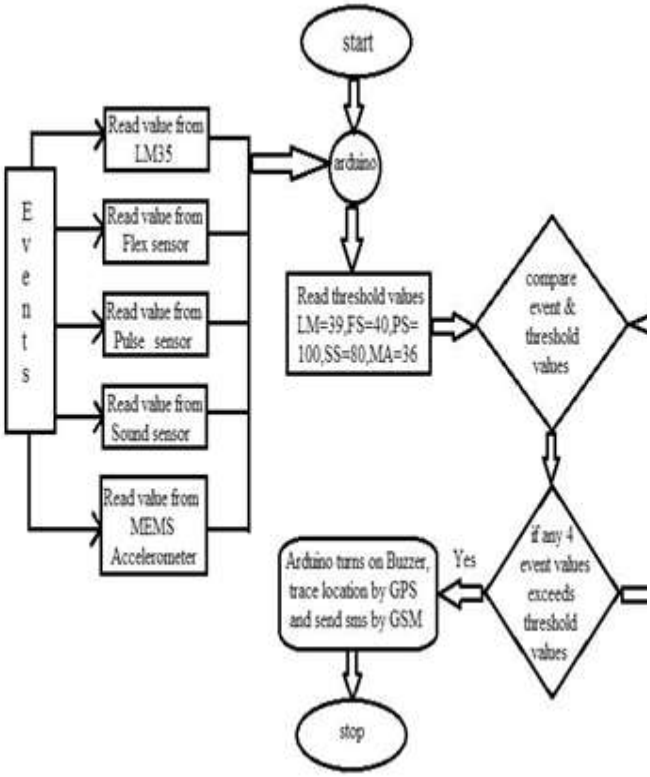

Figure 6: System Flow Diagram

A) VICTIM DETECTION BASED ON BODY TEMPERATURE

When a woman is in a dangerous situation, the sensor detects her elevated body temperature and sends an analogue input signal to the Arduino's A0 pin. As a result, the sensors pick up on the woman's abnormal condition as the temperature changes, and the resulting voltage value is the output signal, which is then displayed on the LCD screen as the woman's temperature reading (whether low or high).

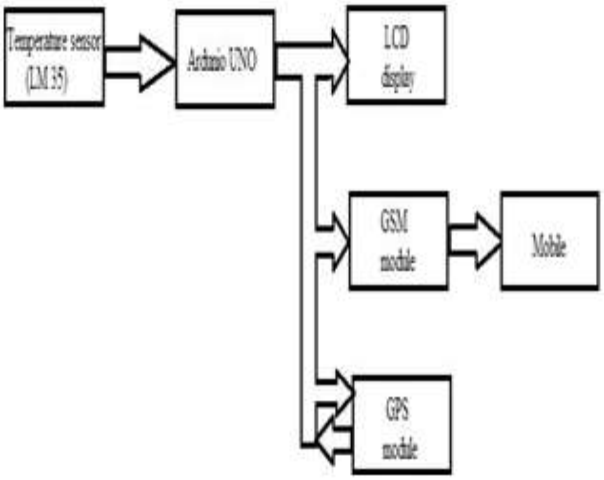

Figure 7: Temperature measurement detection

B) VICTIM VOICE DETECTION

If a woman is in danger, she can protect herself by making loud noises, which are picked up by a sound sensor; if the volume of the sound produced by the woman exceeds a certain threshold value, the sensor's analogue output is used as input by the Arduino.

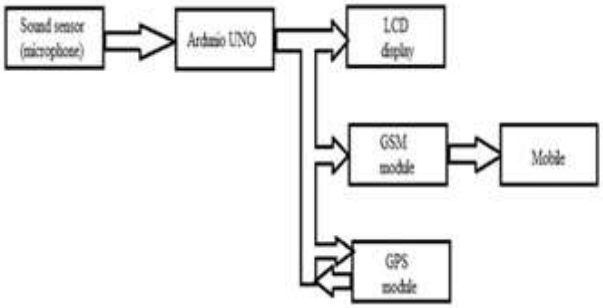

Figure 8: Voice Recognizer

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Since the maximum sound produced in this project is greater than the reference threshold (25–40 decibels), the sensor is activated, the analogue signal is detected, and the sensor output is fed to the Arduino A3 pin as input, where it is processed and converted into a digital value that is then displayed on the LCD.

C) VICTIM FLEX MOTION DETECTION

Fig. 8 shows how the sensor is positioned on the hand to measure the localised variations in resistance. Whether or not the resistance changes as a result of a sudden body or hand bend is unknown. As a result, the sensor is able to pick up on the abnormal value, and this is then displayed on the LCD screen as an alert.

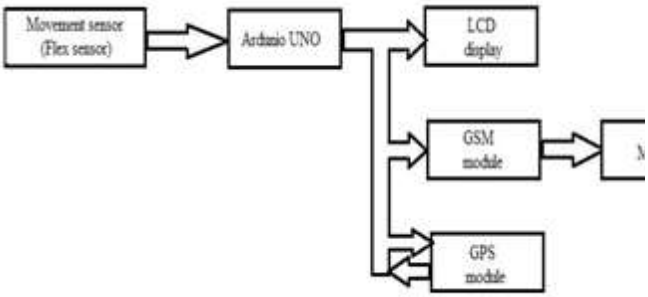

Figure 9: Motion Detection

D. IN ORDER TO MONITOR FOR THE VICTIM'S SUDDEN DECLINE

The controller's analogue pins A4,A5 are wired up to the MEMS accelerometer. Position in X space of As shown in Fig.10, MEMS is wired into the controller's A5 pin, and the Y coordinate is wired into the A4 pin. Many applications make use of the MEMS accelerometer for the purpose of detecting falls.

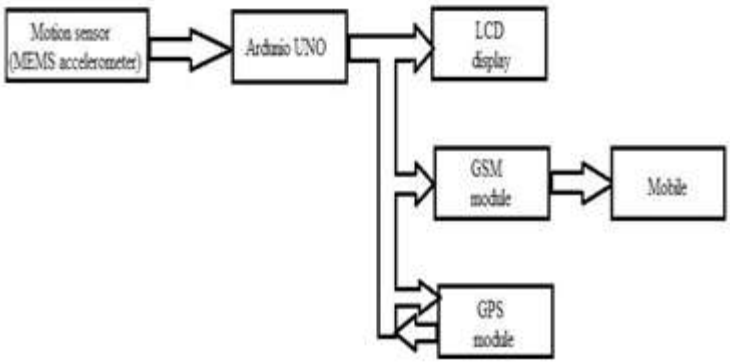

Figure 10 : Detection of Victim's Sudden Fall

The X, Y coordinates determine the value obtained after a person has fallen suddenly, and the device uses MEMS to do so. This allows the output value to be shown on the LCD screen.

E) VICTIM DETECTION VIA PULSE RATE

A normal human heartbeat occurs at a rate of 72 beats per minute. As shown in Fig. 11, the sensor detects the analogue signal and then feeds the output signal to the Arduino when the heart rate of a person reaches or exceeds the threshold (for >100beats /min).

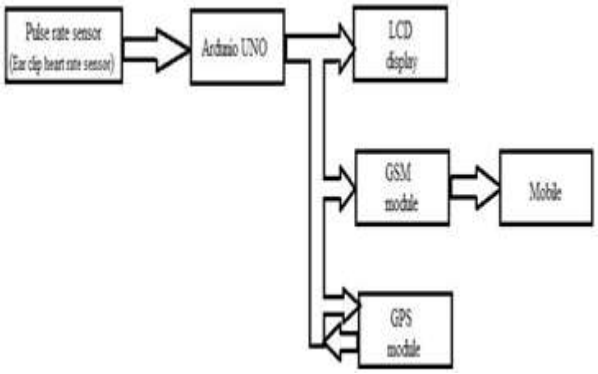

Figure 11 : Detection of a Victim's Heartbeat

In dangerous situations, a woman's heart rate will typically either speed up or slow down. To sum up, the heart rate. Specifically, the rate sensor picks up on the threshold vale, and as a result, the heart rate.

In this case, the Arduino creates the output value (heart rate at that situation) and displays it on the LCD display if the heart rate is above the threshold value, i.e. normal beats of human (72beats/min).

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F) SETTING OFF THE BUZZER

In this case, the buzzer will only emit its sound if four out of the five sensors have been activated. When all four sensors (temperature, flex, MEMS, and sound) are activated, a buzzer sounds, and the GSM 800Lmodule sends an alert message reading "I am in danger" and the latitude and longitude coordinates of the user's current location to the user's emergency contact. Although rare, it is possible for trouble to arise if any of the five sensors suddenly picks up an anomaly and sends a message to the person in question [14]. To avoid this, that person should flip a switch that prevents them from sending messages less than 10 seconds apart. Thus, the person will always be on high alert and safe.

VIII. Experiment Results

Fig.12 depicts the prototype of the women's safety system. Successfully detected and transmitted to Arduino are signals from temperature, flex, MEMS accelerometer, sound, and pulse rate sensors. As shown in Fig.13, the buzzer sounds and the values are shown on the LCD when four of the five aforementioned sensors exceed their threshold values.

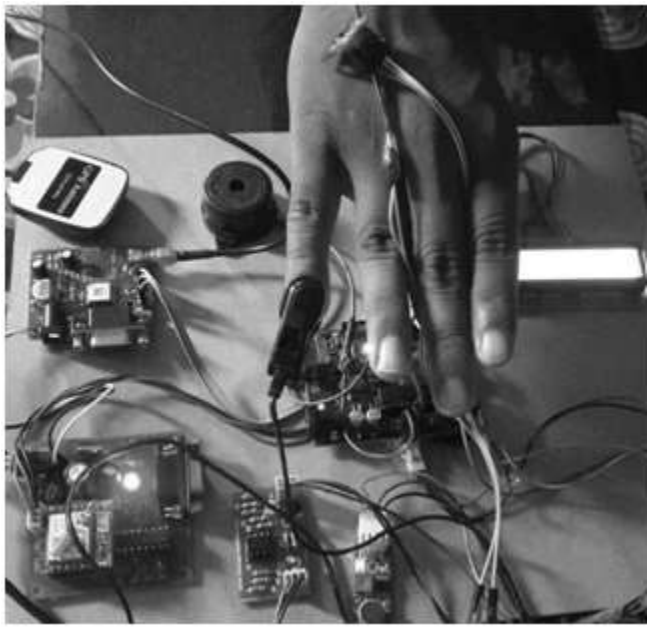

Fig.12: Security system prototype

Figure 13: Victim's LCD Threshold Values

In Fig. 14, we see that when the Arduino detects that four predetermined values have been exceeded, it activates the GPS to track the woman's latitude and longitude and uses the GSM 800L to send a message saying "I am in danger" to the woman's emergency contact number.

Figure 14: Warning signal

CONCLUSION

More research is possible with the introduction of smart technology, where people and objects form a network, and this paper discusses the current applications for women's security and comes up with an innovative idea for security and protection for women. This will facilitate the use of portable machinery and creative solutions to address the issues. Safety alarms that make a lot of noise and that send messages to

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predetermined contacts including the user's location are particularly useful for women. Every woman in the country worries about her safety and security, but this system can put their minds at ease.

FUTURESCOPE

For instance, in light of recent incidents of child crime like child disappearances, abuse, etc., the safety of schoolchildren is a top priority for both parents and school administration. The modules used keep an eye on the well-being of the kids on school buses. When a student arrives at school, the school will disable the tracking device and notify the parents that their child has arrived at school safely. Therefore, the system is more stable and secure thanks to the modern technology. Given that the new modules include features that boost security, it is prudent to adopt them.

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