

Preface Concerning Gunshot Detection Technology

Firearm violence is a daily occurrence in the United States. With the proliferation of firearms, firearm violence will not dwindle anytime soon. Even more disturbing are the many instances where persons with varying violent mental conditions appear to be those killing our children in schools. Of course, the violence is not restricted to schools, but schools are definitely of great concern.

So, there have been some attempts to make schools safer through armed teachers, armed security guards, police officers, panic buttons and even hardened shelters in each classroom. Some are controversial, but all have merits and each are considered layers of security which are helpful.

The use of Gunshot Detection Technology is a passive way to protect those in our schools, banks, restaurants, supermarkets, business offices, 24 hour convenience stores, etc. The detection of a firearm event will immediately report the event to police via alarm systems within the building. Gunshot detection technology already exists in long range applications. Why not utilize it in short range applications?

In a building scenario, Gunshot Detectors (GSD) resemble typical smoke detectors mounted on ceilings or walls. They detect the audio properties of a muzzle blast. Through the filtering process ambient sounds other than the distinct audio properties are filtered out. Only true audio characteristics would be processed through the detector and if the event is verified, an alarm condition is sent to the alarm company or directly to the police. Because each device is zoned through location, mapping for responders could be available. Tactical responses would expedite removing the threat and potentially saving lives.

Because the GSD is basically a smart switch, the potential use of GSDs could be definite a lifesaver. *Imagine not only using it as a passive alarm peripheral device, but also as an automated proactive action to deny the shooter his intended victims.* GSD would be used in conjunction with electromagnetic door technology, which has been very successful in securing buildings.

So in this scenario a shooter enters a building and fires his weapon. The following would happen:

- GSD sends a signal to the alarm panel for notification and to electromagnetic door controller panels.
- All doors are normally held open with an electromagnetic door holder during normal conditions. Once the signal is received all electromagnetic door holders release the doors being held and the door closing mechanisms close the doors automatically.
- As the doors are released and closed, a large electromagnetic door lock now holds classroom doors, office doors and restroom doors closed with over 1,000 lbs of holding power.

- This is called compartmentalizing. In essence, the office or school complex becomes a secure complex. This will preserve life and create safe havens for students, teachers and employees.
- If the shooting begins in a hallway, all doors leading to rooms will be locked. If the shooting occurs in a room, occupants can escape through the door. Passive infrared detectors over each inside door allows exit. All other doors remain locked, thus denying access to any other students, teachers and employees.
- Classrooms or some select rooms, could be set up with a keypad to temporarily unlock a secure room for those caught in hallways. Also, the locked doors can have bypass methods built in. The doors should be hardened to be able to resist physical attack for at least 15 minutes. A master control shunt and activation switch could be setup for supervisory and police personnel in a secured location.

While this scenario is only fiction, it is possible to achieve this protection through this technology.

Additionally, this very same technology (miniaturized) could be body worn by primarily police officers. Each year, many police officers are killed in the line of duty by firearms. The concept is to make it safer for officers and with this technology bring aid to the officers much quicker. It would give officers an edge in the apprehension of the shooter through early notification the officer is in need of aid. Here are some points of a Firearm Event Detector (FED):

1. **Firearm Event Detector (FED)** is a body worn system.

- Primarily for law enforcement officers, but could be used for judges, bailiffs, school teachers, store clerks and many others who might need the additional protection. The device would give officers an edge if they are involved in a shooting where additional police or medical support is needed and they are unable to call for help. Several officers are ambushed each year by assailants with firearms.
- Attached to the upper uniform or make it a wearable tech device.
- Battery powered. Quick change battery. Rechargeable. Indicator light for low battery.
- Hardened case and water resistant with optional ways to attach to clothing or to the upper body.
- Detection range approximately 60 feet. Consider using a microphone gain adjustment control. The majority of officers killed by firearms are killed within 50' or less.
- The device would contain Bluetooth to interface with the wearer's cell phone. Other telemetry could be added for unique needs.
- An alarm condition (firearm event) activates Bluetooth.

- The Bluetooth sends alarm condition to the smart phone or even the police cruiser computer system
- Through a specially designed software for an I-Phone, Android phone and/or computer could send the location of the incident and other determined conditions to the police dispatcher or monitoring center.
- The system could be upgradeable via firmware
- The system to be controlled by encryption to ensure proprietary control, which opens up leasing options and maintenance.

In conclusion, we live in fear everyday of a new Columbine or Sandy Hook tragedy. With the aforementioned technology, we can make our school buildings smarter through certain forms of automation. We can make immediate notification the second a shot is fired, compartmentalize each room immediately, thus protecting our children and young adults. We can give better odds an officer will survive a firearm attack. All that is needed is a serious manufacturer that shares this dream to step forward to make this technology a reality.

Gunshot Detector

The Gunshot Detector is basically a smart switch that will summon police and emergency personnel or activate safety devices whenever a firearm event occurs in prohibited areas such as schools, courts, business offices, banks, restaurants, other retail establishments and/or wherever protection might be needed. Included is a wearable device specifically for police officers ambushed by assailants with firearm(s).

The following information pertains to three (3) invention ideas all in connection to a gunshot detector comprised of:

1. Acoustic microphone filtered for frequencies characteristic of muzzle blasts
2. Band pass filtering conducive to the audio frequency characteristics of firearm muzzle blasts. Other ambient sound frequencies would be filtered out. A 2 or 3 stage filtering process is desirable to avoid false alarms.
3. Logic circuitry capable of comparative analysis of the incoming audio, thus giving a yes or no to either continue in the process or be terminated.
4. In connection with logic circuitry, a central processing unit (CPU) could incorporate a firearm library of muzzle blasts to further refine the possible incoming muzzle blast analysis. The device should possibly have to ability to be upgraded via firmware.
5. A confirmed firearm event would actuate a signal to:
 - A cellular device
 - A Bluetooth device, which would send alarm via cell phone, computer or telemetry device
 - An alarm panel and/or computer to summon immediate help
 - Control panel(s) for electromagnetic locking devices
 - A texting device for mass notification
 - Any automation device conducive to safety

In case audio detection is not capable of rejecting false alarms alone, the addition of light wave detection from the muzzle flash of a firearm can be optional. It would be comprised of:

1. Optical band pass filtering allowing in either mid infrared or near infrared light waves produced by characteristic muzzle flashes. When using filtering light waves not conducive to a firearm muzzle flash would be rejected. Layers of filtering would be desired.
2. The sequence of light followed by sound would have to match certain timing parameters to make it through logic circuitry.
3. Both sound waves and light waves would have to present to process through to an alarm actuation. In buildings, reflective light off floors and walls being detected would be desired.
4. Limited detection range which cover just the zone it is intended to cover. An overlapping of sensor activation should be avoided if possible to exact the event location.

There are 3 separate conceptualizations related to the Gunshot Detector:

2. The Gunshot Detector (GSD) is an alarm peripheral device looking very similar to ceiling mounted smoke detector or a wall mounted glass break detector. Each unit would be connected to a burglar alarm panic zone circuit. More sophisticated designs could actually be dedicated and supervised alarm panels where each device has its own alarm zone. Limited detection range which would cover just the zone it is intended to cover. An overlapping of sensor activation should be avoided if possible. Possibly allow for a microphone gain control to adjust for desired coverage space.
In this configuration, a triggered zone would reveal where responders should concentrate their response to the originating zone activation. Also each unit should have diagnostic capabilities along with a tamper proof circuitry.
These units immediately send a signal to an alarm panel which is expeditious. Police will be notified quicker and will actually know where to go if the system is zone designated. The GSD, when paired with an alarm panel, electromagnetic door control panel or any automation safety device could play a critical role in life or death situations.

3. Guardian Barrier System (GBS) incorporates an *actual proactive system which will deny the shooter access to the intended children targets*. Its denial will allow more crucial time for the police to arrive. The GBS works in tandem with the GSD and alarm panel notification, but it does the following:
 - Sends a signal to the alarm panel for notification and to electromagnetic door controller panels.
 - All doors are held open with an electromagnetic door holder.
 - Once the signal is received all electromagnetic door holders release the doors being held and the door closing mechanisms close the doors automatically.
 - As the doors are released and closed, a large electromagnetic door lock now holds classroom doors, office doors and restroom doors closed with over 1,000 lbs of holding power.
 - This is called compartmentalizing. In essence, the office or school complex becomes a secure complex. This will preserve life and create safe havens for students, teachers and employees.
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physical attack for at least 15 minutes. A master control shunt and activation switch could be setup for supervisory and police personnel in a secured location.

4. **Firearm Event Detector (FED)** is a body worn system.

- Primarily for law enforcement officers, but could be used for judges, bailiffs, school teachers, store clerks and many others who might need the additional protection. The device would give officers an edge if they are involved in a shooting where additional police or medical support is needed and they are unable to call for help. Several officers are ambushed each year by assailants with firearms.
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- The Bluetooth sends alarm condition to the smart phone or even the police cruiser computer system
- Through a specially designed software for an I-Phone, Android phone and/or computer could send the location of the incident and other determined conditions to the police dispatcher or monitoring center.
- The system could be upgradeable via firmware
- The system to be controlled by encryption to ensure proprietary control, which opens up leasing options and maintenance.
- Optional: A recessed duress button when it is impractical to call for help
- Optional: A beacon flash to be activated after a firearm event when there is no activity and possibly remotely. This would be to locate an injured officer.
- Optional: Include an impact sensor specially designed to trigger in the case of an auto accident.
- Optional: Bio sensor for officer's status
- Optional: Ability to open listening capability by the monitoring authority

Inventor Conceptualization Diagrams for the Gun Shot Detector (GSD), Firearm Event Detector (FED) and Guardian Barrier System (GBS)

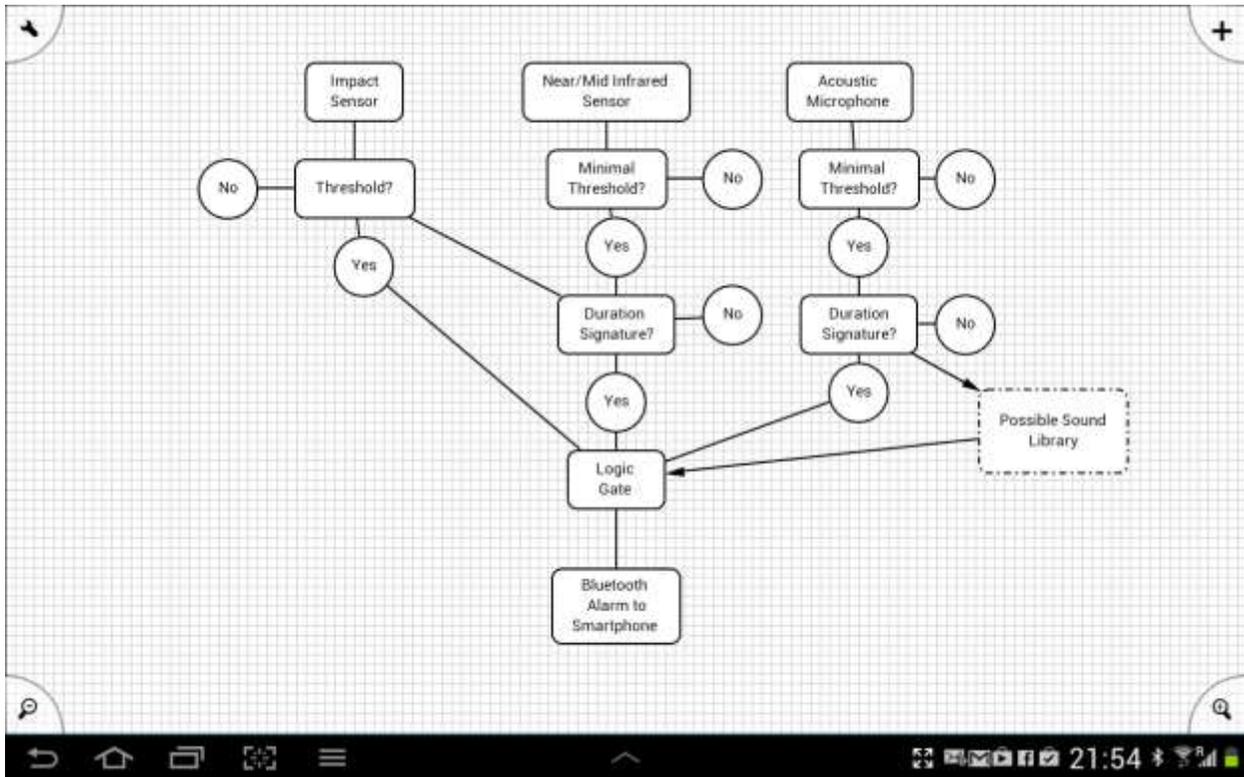


Fig 1

Figure 1 represents a combination of light sensor and acoustic microphone coupled with an impact sensor for a body worn Firearm Event Detector. Approximately 1/3 of police officer deaths are vehicular accident related and another 1/3 are firearm related when they are shot at. Many of the shootings occur when an officer is ambushed. In some cases, the officer didn't have a chance to report a shooting and they are subsequently found injured or dead later by bystanders. The impact sensor would be capable of sensing traumatic impact conducive to an auto accident. The impact sensor is clearly an add-on to the FED. In this figure #1 both light wave and audio sensing are present.

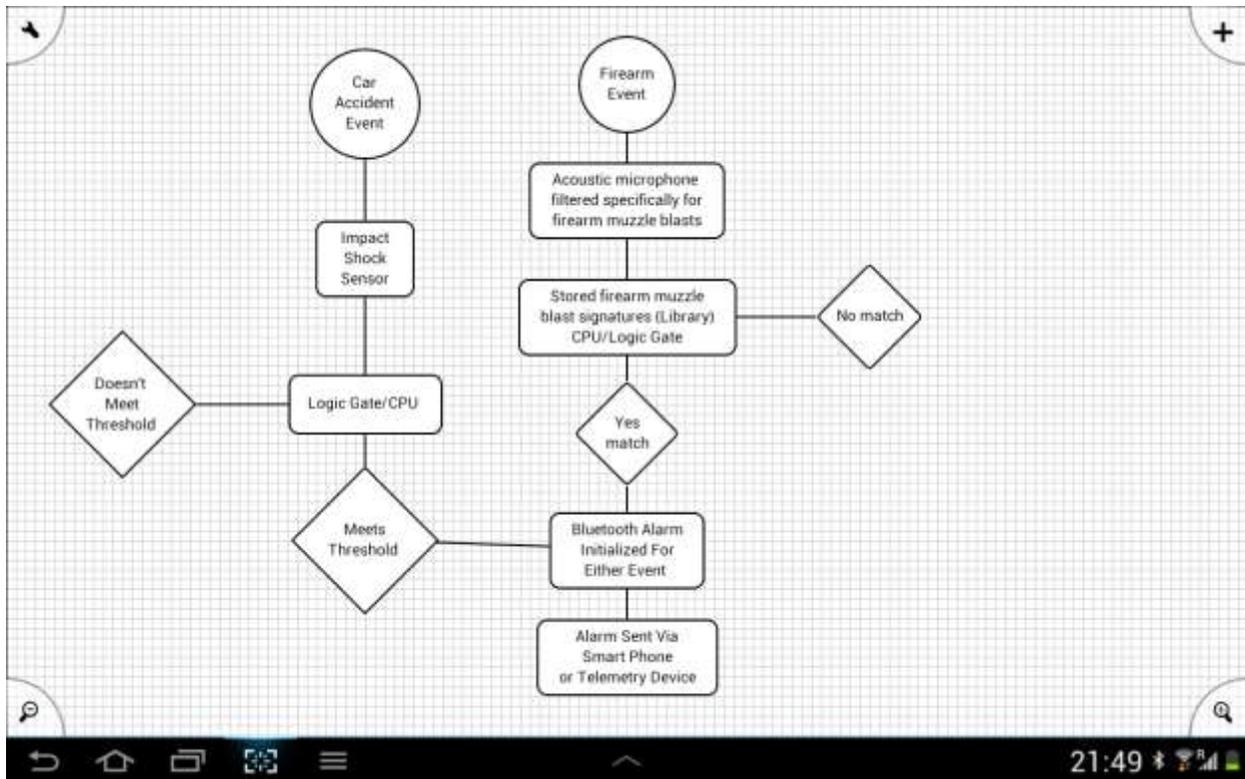


Fig 2

Figure 2 represents a combination of an acoustic microphone coupled with an impact sensor for a body worn Firearm Event Detector. Approximately 1/3 of police officer deaths are vehicular accident related and another 1/3 are firearm related. The impact sensor would be capable of sensing traumatic impact conducive to an auto accident. The impact sensor is clearly an add-on to the FED. In this figure #2 only audio sensing is present. It is believed audio sensing in this case might be more advantageous as the detection would be omnidirectional opposed to the light and sound combination being omnidirectional with light detection being very directional (frontal only), unless light sensing could becoming omnidirectional.

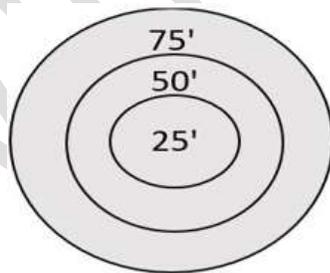


Figure A

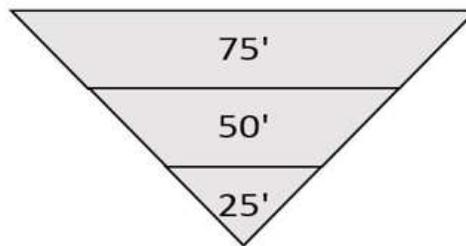


Figure B

Figure A is an example of omnidirectional detection using audio only detection. Figure B depicts using light sensing. Clearly, Figure B would not be attractive if an officer was attacked from the rear or sides, unless light detection could be broadened. Figure B along with audio detection would be feasible with a GSD mounted in buildings as multiple sensors would be more practical.

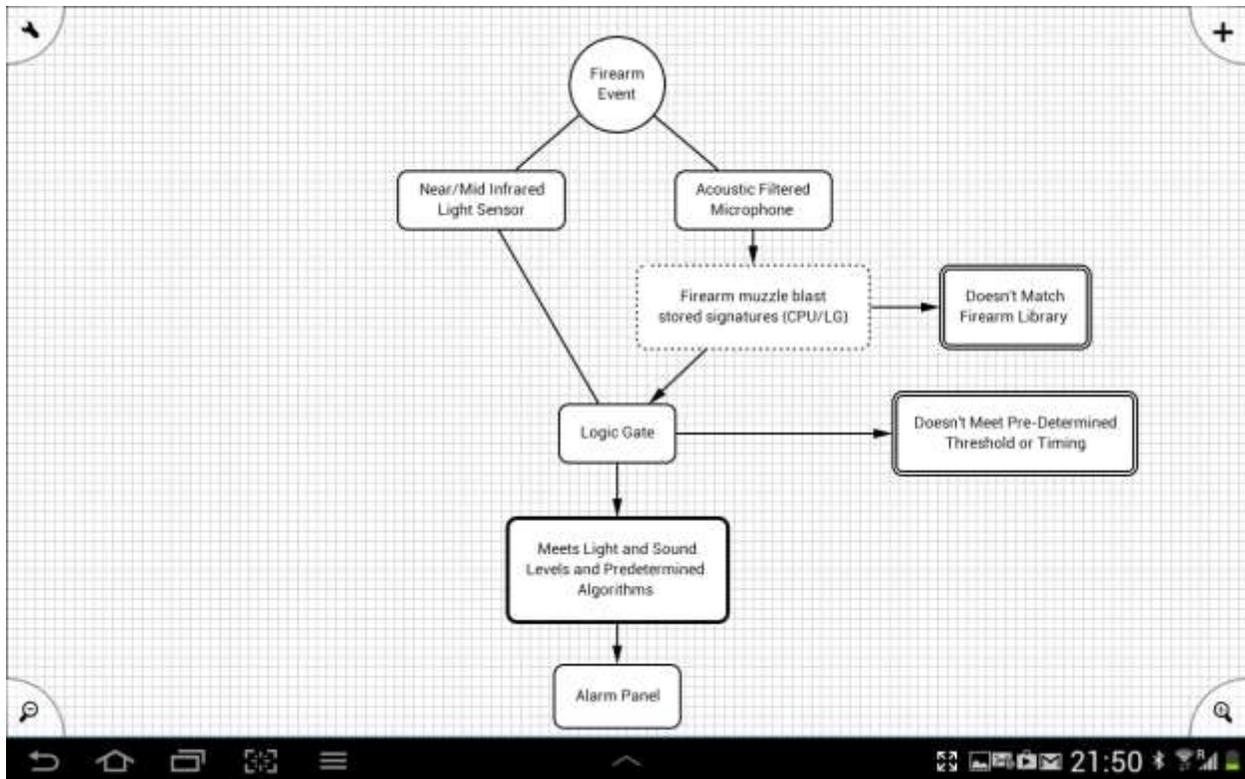


Figure 3

A combination of light sensor and acoustic microphone. In this figure #3 both light wave and audio sensing is present and would be used in a building based Gun Shot Detector.

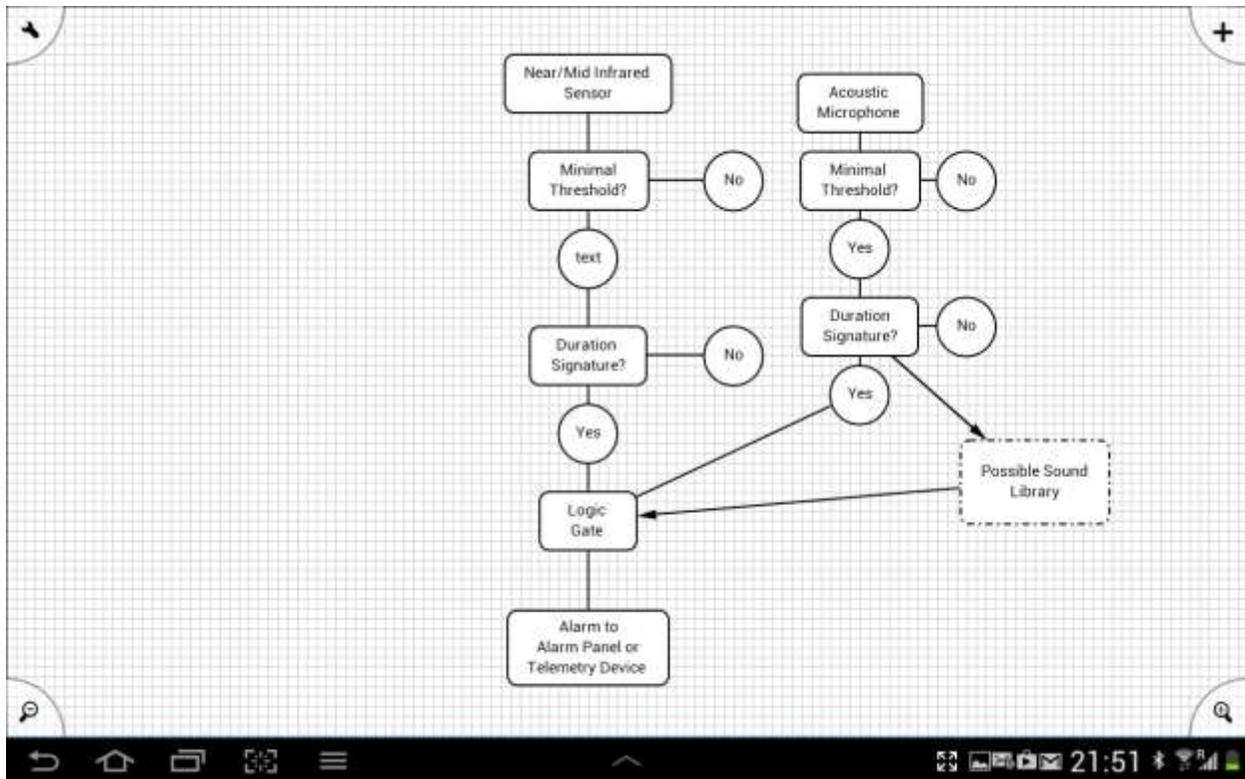


Figure 4

A combination of light sensor and acoustic microphone. In this figure #4 both light wave and audio sensing is present and would be used in a building based Gun Shot Detector. Alarm sent to the alarm panel, telemetry device and/or electromagnetic door controller panel(s).

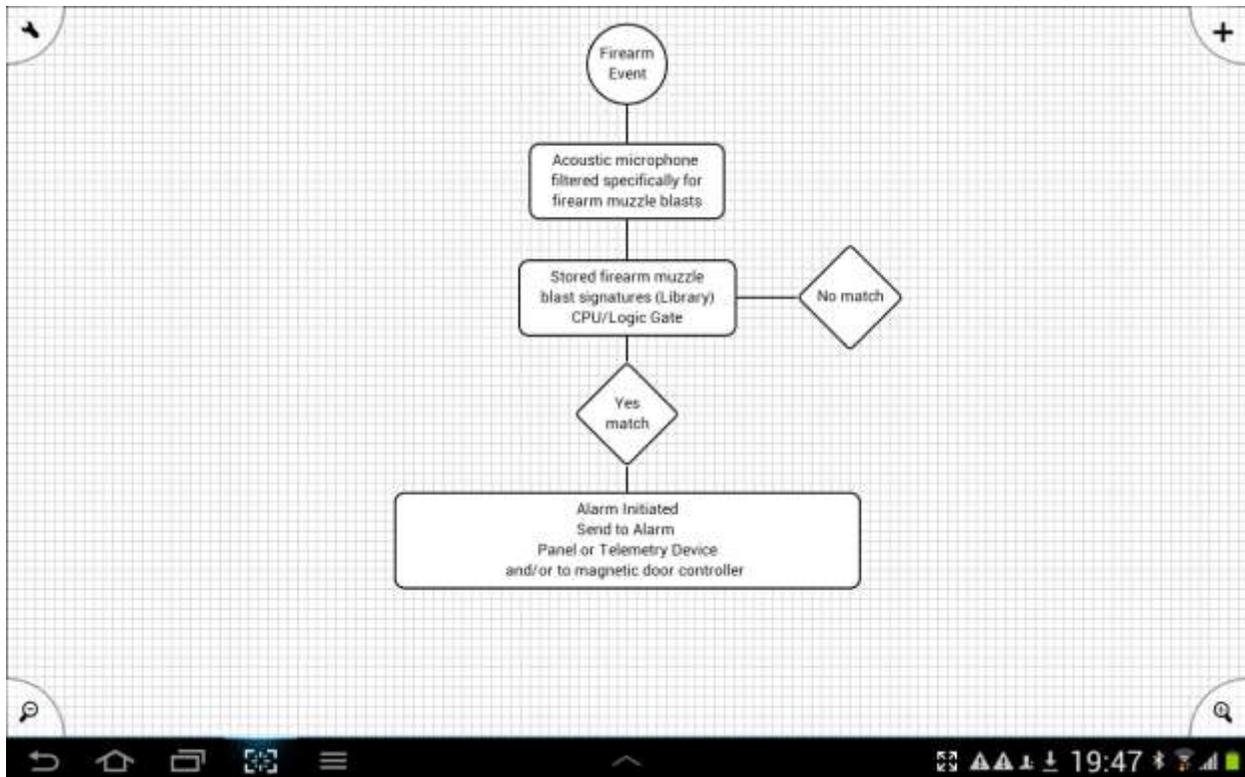


Figure 5

This unit would only use an acoustic microphone. In this figure #5 only audio sensing is present and would be used in a building based Gun Shot Detector. The key is to match the muzzle blast characteristics to either a pre-stored firearm library of muzzle blasts from all conceivable firearms or to use a logic gate with a configured algorithm of muzzle blast characteristics. This is one of the most simple conceptions, but one which could easily be mass produced. Ambient sounds like gunshots on televisions and radios should be capable of being rejected through the circuitry. It would be advantageous to be able to upgrade the GSD in the form of firmware. However, logic circuitry designed for basic detection of muzzle blast characteristics might suffice.

Alarm sent to the alarm panel, telemetry device and/or electromagnetic door controller panel(s).

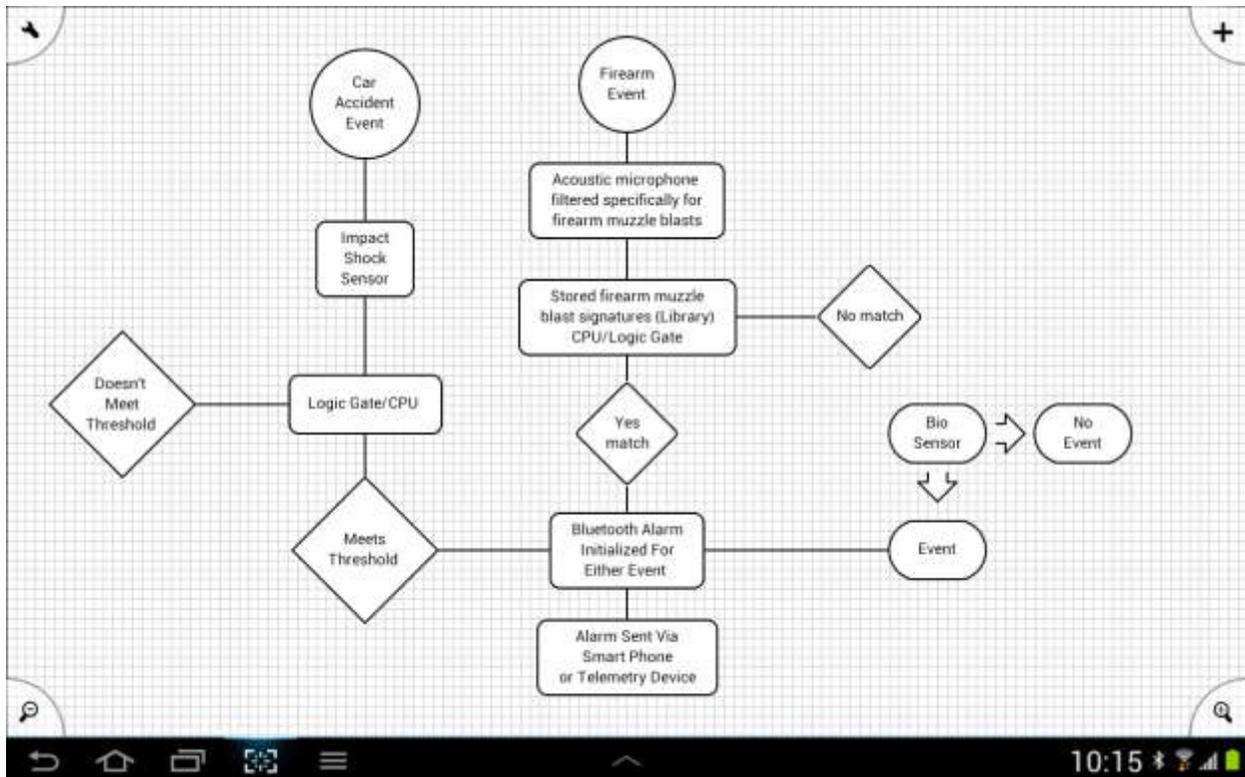


Figure 6

A combination of an acoustic microphone coupled with an impact sensor for a body worn Firearm Event Detector. Approximately 1/3 of police officer deaths are vehicular accident related and another 1/3 are firearm related. The impact sensor would be capable of sensing traumatic impact conducive to an auto accident. The impact sensor is clearly an add-on to the FED. Another optional detection sensor included is a bio sensor to activate in the event of a Firearm Event or a Traumatic Impact Event.