Artificial Intelligence in the Criminal Justice System: A Literature Review and a Survey

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Abstract- Companies, governments and security services around the world are now trying to use artificial intelligence to detect and prevent crime. Studies have shown that crime is predictable. The need is to just filter out large amounts of data to get useful legal patterns. These types of predictions were a dream just a few decades ago. However, there is much hope now, as we learn from the fast-paced development of Artificial Intelligence (AI). When it comes to why governments and corporations are willing to try to use AI in this way, a summary of the key findings is as follows: It is estimated that in 2018, national and local governments have spent $ 119 billion on the police, $ 81 billion on repairs (3%), and $ 49 billion on the courts (2%). AI has the potential to be a permanent part of our justice environment, providing assistance in investigating and allowing criminal justice professionals to better maintain public safety. The main intention and aspiration of this research is to let people be aware about AI and how it can be successfully applied to achieve excellent results in criminal justice systems, not only to detect crimes but to also predict them and prevent them from occurring. On the other hand, the extended part of this research explores the thought of measuring the ability and the possibility of applying AI in the Sri Lankan criminal justice system.

Keywords: artificial Intelligence, criminal justice system, machine learning

I. INTRODUCTION

Let's go through the current judging system before appreciating the role of AI in the environmental justice system. Imagine being arrested for armed robbery and suspected of being involved when you did not have a part to play, and you are completely innocent. The reason for your arrest is that you look like a suspect, and you live near a crime scene. Also, your car is the same as the statement made by witnesses. There is no more serious reason than the above, you will be made to appear before a judge after booking. The judge will then look into the situation before setting a bail order. An assessment of your aircraft risk and type of crime will be conducted, and only then will it be up to the judge to decide whether to take the call. Morning trials are often more than just seeing judges as soft. However, it was introduced before lunch. The judge, as soon as possible, set you up for bail without even having the opportunity to pay. This will send you to court, and you will be sent to prison without hesitation. It is a very serious mystery from many situations. Your case is unconfirmed, but you find yourself trapped hopelessly within the criminal justice system which leaves very little way out. The effects are already beginning to manifest themselves over your life. Normally, there is an average period of six months from your arrest to conviction. You will not have your job; the amount of bail planning will bring about a decrease in your credit ratings and many such negative effects. And while you were undoubtedly innocent, you were imprisoned with serious criminals. That's not much good news, is it? Prior to the role of AI, predicting and detecting crime was difficult as mentioned above. Since no crime finds a need for a new way to predict and detect crime it was needed.

AI was introduced to join criminal justice to make the world a better place. Artificial intelligence has

the potential to be an integral part of our justice system, providing investigative assistance and allowing criminal justice professionals to better maintain public safety. There have been wars between governments and the world's criminals. Although crime rates in many lands have dropped dramatically, criminal activity has not been done properly. According to an FBI report, the crime rate and violent crime rates have dropped by 3.3% and 6.3%, respectively, in the USA.("The rise of AI in crime prevention and detection," 2019)There are many technologies that can help police reduce crime, and AI is one of them. Companies and cities around the world are investing in crime prevention AI and detection. The idea of investment is that crime can be predicted and easily detected using AI programs. In order for governments to prevent crime, they need to be able to organize large amounts of data to find patterns that can be useful to law enforcement, and AI algorithms can. The proliferation of AI in crime prevention and crime helps companies and governments reduce crime. AI can be used to predict crime, prevent crime, and detect crime. The goal of any society should be not just to catch criminals but to prevent crime from happening from the start. Predictability analysis is a complex process that uses a large amount of data to predict and create potential outcomes. In criminal justice, this function is mainly applied to the police, probation officers, and other professionals, who have had to acquire technology for many years. Work is time-consuming and is subject to bias and error. and the quality of legal interpretation by judges, lawyers, prosecutors, administrative staff, and other professionals. Investigators think that a computer program could automatically detect certain types of statements that play important roles in legal interpretation. for cybercrime. AI is also able to analyze a large number of records related to criminal justice to predict criminal recovery. AI can also help identify potential victims of physical and financial abuse. Finally, AI is used to predict potential victims of organized crime and organization-based violence. When it comes to crime detection the infrastructure of each city is becoming smarter as governments try to expand their countries at a faster rate. Intelligent and connected international infrastructure provides government officials with real-time information. With the help of AI, real-

time data can help detect crime as soon as it happens. Finally, AI can also be used to prevent crime. crime does not happen automatically, a collection of patterns. And AI can read patterns accurately. The use of AI technology can help monitor content. Content monitoring can help predict. And crime prevention will eventually help prevent it. AI can help monitor a person's digital steps and detect any unusual activities. The purpose of the law should not be to catch criminals but to prevent crime in the first place.("Crime Prevention," n.d.) Let's explore how crime prevention can be achieved with the help of AI.

The rest of the paper is consisting as follows. The second section of the paper will give a brief introduction to the criminal justice systems around the worlds. As a sub part of the same section, I have described the Srilankan criminal justice systems in a nutshell. In the section three it describes the related work. There I have explained few burning areas which AI is applied in real world crime detection and prevention scenario. Section four presents the questionnaire which I to gather information about the knowledge and interest of people based on collaborating Artificial intelligence with Criminal justice system. In the next section I have done a brief analysis about the whole paper. Finally, the conclusion is presented as the last section. Then I have provided all the references that I have used to complete this research.

II. CRIMINAL JUSTICE SYSTEMS IN THE WORLD.

The criminal justice system is a set of legal and social institutions to enforce criminal law in accordance with a defined set of rules and regulations.("The Criminal Justice System | Introduction to Sociology," n.d.) Criminal justice systems include several large subsystems, consisting of one or more public institutions and their employees: the police and other law enforcement agencies; trial and appeal courts; prosecutions and public Defence offices; testing and parole units; childcare facilities (prisons, prisons, transit centers, boarding houses, etc.); and correctional departments (responsible for some or all of the probation, pardon and child custody services).("Criminal Justice System - Structural And Theoretical Components Of Criminal Justice Systems, The Systems In

Operation, The Importance Of Viewing Criminal Justice As A System - JRank Articles," n.d.) Criminal justice systems can be freely classified as common law, public, Islamic, or scientific in nature. Today, however, many authorities have adopted hybrid models that include a variety of legal systems.("Criminal law," 2021) Many of these programs share the same basic set of values. In addition, most criminal justice systems have adopted legal legislation. Almost all criminal justice systems are run by the same actors. An effective justice system is essential to the rule of law, as it works to reduce crime and provide victims with compensation. In particular, the resources for the criminal justice system underpinning the law should be equal, impartial, and respect the human rights of those affected - those who have been traumatized and accused.("OHCHR | Basic Principles of Justice for Victims of Crime and Abuse of Power," n.d.)

A. *Srilankan* criminal justice system.

Sri Lanka has been home for many communities for a long period of time. Sinhala, Tamil, Muslim are the dominant Ethnic groups. Buddhism, Hinduism, Islam, and Christianity are the dominant Religions. Further some geographical areas are dominated by certain communities whilst other areas have mixed communities. The local laws were influenced by this multi-ethnic and multi-religious characteristic. With regard to the formation of the government, Sri Lanka became independent in 1948 and is now an independent republic within the common nations. According to the colonies under British rule, British law was gradually applied throughout the nation("Criminal Justice System Of Sri Lanka," n.d.). However, because of the unsatisfactory nature of the existing criminal laws that led to the uncertainty, the Penal Code of Sri Lanka, then Ceylon, came into force in 1833("Penal_Code.pdf," n.d.). It is said that the law was based on the corresponding Indian law. In 1974, the Administration of Justice Law was introduced but continued for only 4 years. The current law is the Code of Criminal Procedure Act, enacted in 1979. Also, the Judicature Act was enacted in 1978("Judicature Act | Volume IV," n.d.), which provides the basis for the administration of justice. As for the court system, the process and functions of criminal courts today are governed by the Code of Criminal Procedure Act and the Judicature Act. The Magistrate's Court is a criminal court that will deal with a number of cases, and the High Court will also deal with other lesser crimes. Legally, other serious crimes, such as murder, attempted murder and rape, are being tried in the Supreme Court. The case in the Supreme Court is handled by a judge and a judge or a judge only. The judge is made up of seven judges, who are randomly selected from a panel of judges. An appeal or second case of criminal conviction is made by the Court of Appeal.("Judicial Hierarchy," n.d.) The Supreme Court exercises the final power of appeal and the special power of suspicion for violating fundamental rights and freedoms guaranteed under the Constitution. The Supreme Court has 11 judges, including the Chief Justice. Judges of the Supreme Court and appellate judges and high courts are appointed by the President; lower court judges appointed by the Judicial Services Commission. The Commission is the administrative body of the judiciary consisting of three judges of the Supreme Court headed by the Chief Justice. Most criminal prosecutions are carried out by investigators, namely the police themselves. However, in the case of such serious cases to be tried in the Supreme Court, whenever the need arises, public prosecutors, who have the right to be Government Councils or State Attorneys, will prosecute cases.("Judicial Hierarchy," n.d.) These public prosecutors are under the auspices of the Department of General Law and are overseen by the Attorney-General, appointed by the President.

III. RELATED WORK.

Artificial Intelligence or simple AI is a rapidly evolving field of computer science. In the mid-1950s, John McCarthy, known as the father of AI, described it as "the science and engineering of intelligent design".("The History of Artificial Intelligence - Science in the News," n.d.) In theory, AI is the ability of a machine to recognize and respond to its environment independently and to perform tasks that may require human ingenuity and decision-making processes, but without direct human intervention.("What is Artificial Intelligence (AI)?," n.d.) One aspect of human intelligence is the ability to learn from experience. So, AI programs will show at least some of the following behaviors associated with human intelligence: planning, learning, consulting, problem-solving, knowledge representation,("What is AI? Everything you need to know about Artificial Intelligence | ZDNet," n.d.)

AI wants to replicate this human capability in software algorithms and computer hardware. For example, self-study algorithms use data sets to understand how you can see people based on their photos, complete complex computational and robotic tasks, comprehension purchasing habits and patterns online perception, motion, and manipulation and, to a lesser extent, social intelligence and creativity .Artificial intelligence has the potential to be a permanent part of our criminal justice ecosystem, providing investigative assistance and allowing criminal justice professionals to better maintain public safety("Using Artificial Intelligence to Address Criminal Justice Needs," n.d.). Let's explore how AI is now being used in the context of crime and Criminal proceedings. Artificial intelligence is increasingly being used by courts in numerous countries throughout the world in their decision-making processes. In this research we thought of addressing few burning areas which AI is applied in real world crime detection and prevention scenario.

When discussing about applying AI in criminal cases it can be mainly classified into two areas as AI for crime detection and AI for crime prevention.

A. AI for crime detection.

i) *DNA Analysing.*

AI can also benefit a society that enforces the law from science and forensic evidence. This is especially true of forensic DNA tests, which have had an unprecedented impact on the justice system in recent years. Organisms, such as blood, saliva, semen, and skin cells, can be transmitted through contact with humans and objects during crime(Dupont et al., 2019). As DNA technology evolved, so did the sensitivity of DNA analysis, allowing technology scientists to discover and process low-quality, corrupted, or inaccessible evidence that could not be used before. For example, decades of DNA evidence from violent crimes such as sexual assault and cold-blooded murder cases has now been submitted to laboratory for analysis. As a result of greater sensitivity, smaller amounts of DNA can be detected, resulting in more DNA being obtained from multiple donors, or at much lower levels.("AI could revolutionize DNA evidence – but right now we can't trust the machines," n.d.)

ii) *Gun Shot Detection.*

The discovery of pattern signatures in gunshot analysis provides another area in which we can apply AI expertise. In one project, the NIJ("Using Artificial Intelligence to Address Criminal Justice

Needs," n.d.) sponsored Cadre Research Labs, LLC, to analyze audio files from Smartphones and smart devices "based on the recognition that the content and quality of firearms were influenced by the type of guns and ammunition, incident geometry, and recording device used.(Dupont et al., 2019) Using a well- defined mathematical model, Cadre scientists are working to develop algorithms to detect gunshot targets, to detect bullet waves in shock waves, to determine the timing of a shot, to determine the number of available guns, to assign a shotgun, and to estimate the probability of class and size legal authorities in the investigation.("The rise of AI in crime prevention and detection," 2019)

iii) *Public safety videos and images.*

Video and image analysis is used in criminal justice and law enforcement communities to obtain information about people, objects, and actions to support criminal investigations. However, the analysis of video and image data requires a lot of staff, requiring significant investment in the knowledgeable staff of the story. Video and image analysis is also prone to human error due to the abundance of information, the rapid change of technology such as smartphones and apps, and the limited number of specialized staff with experience in processing that information("Assistive AI keeps the human element in public safety | 2021-06-04 | Security Magazine," n.d.). AI technology provides the ability to overcome such human mistakes and to act as an expert. Traditional software algorithms that help people are limited to predetermined factors such as eye shape, eye color, and the distance between eyes to see face or human details for pattern analysis. Video algorithms and image AI not only learn complex tasks but also develop and determine the complexities / limitations of their complex facial expressions to perform these tasks, more than people can imagine. These algorithms have the power to match faces, identify weapons and other objects, and detect complex events such as accidents and ongoing crime or behind reality.("Using Artificial Intelligence to Address Criminal Justice Needs," n.d.)

iv) *Digital Forensics.*

Digital forensics, also called computer forensics, is a function of extracting and analyzing digital content devices to prove it("What is Digital Forensics? History, Process, Types, Challenges," n.d.). There are many tools for that combed with

computers, mobile devices, and software views with evidence of details that might incriminate. Done wisdom works here because it increases power of digital analysis tools, highly productive the amount of data that no one has the ability to understand timely processing. One key example is software called Magnet AXIOM, developed by Magnet Forensics based in Waterloo, Canada. The tool is called "a digital investigation platform that allows researchers to discover and check the relevant information from smartphones and computers, to visualize it for better analysis. "A key feature of the software its use of Magnet.AI, which uses machine learning to perform semantic analysis or conversational content in Smartphones, computers, and chat apps. Company states that the tool is designed for cases of children exploitation and seeks to classify and flag the language conversations that can attract children.("Magnet AXIOM Cyber | Magnet Forensics," n.d.) Company it highlights the fact that this tool will change the way police behave their conversations and participation in arrests. It's clear that the AI can be used in crime detection as in the same way AI can be used in crime forecasting("Artificial Intelligence Is Now Used to Predict Crime. But Is It Biased? | Innovation | Smithsonian Magazine," n.d.).

B. AI for crime prevention.
  i) Predicting the crime spots.

Imagine a thief coming to his next heist to find out that the police are already waiting for him. Yes, it can be done using AI technology. AI programming, along with big data, can help identify crime hotspots. Crime types often interact with space and time, and crime-related information such as crime type, crime scene, and crime weapons can help predict future crime scenes. For example, an outbreak of theft in one area may help predict that similar incidents may occur in the surrounding area in the future. AI programs can help police find a place where they should consider extra vigilance.

ii.) *Predicting who will commit the crime.*

Many times, criminals talk about crimes committed online. AI can help monitor online content transfer. Algorithms can detect any unfamiliar words related to cybercrime. AI programs can then send information to the relevant law enforcement agencies about any unusual activity or communication that takes place between criminals, which can help identify potential criminals. Also, facial expressions can ultimately help to predict who will commit the crime. With facial recognition and tracking,

behavioral changes can help AI programs predict a person's future actions.

iii) Deciding for the pretrial release.

After indictment in any case, many suspects are usually released from prison until they appear in court. In the traditional system, judges must decide within minutes whether a person is a flying danger or a serious threat to the community, whether or not that person will harm a witness if released. The traditional system is an incomplete system open to discrimination, as judges tend to issue various judgments in their view of crime. AI can improve the current system and help determine individual release. AI algorithms can detect many dangerous objects before removing a defendant. Some of the dangers that can be considered are any cases that are still pending during the trial, conviction for violent offenses, failure to appear before a court hearing and sentencing before arrest. Based on many such factors, AI programs can accurately determine whether a person should be granted early release or not.

The use of AI in crime prevention and detection allows the company and city officials to reduce crime with precision. While crime rates have been declining for decades, global spending on law enforcement is increasing. With the benefits of AI comes a few risks in using AI to prevent and detect crime. For example, a person may be identified as a criminal or suspicious of criminal activities based on racial prejudice that may be unintentionally built into the AI system. Such risks should be clearly and explicitly assessed to determine whether the use of AI to prevent crime is appropriate or not.

IV. RESEARCH METHODOLOGY.

As it was mentioned earlier my main intention and the aspiration of performing this research study is to let people aware about the AI and explore how AI can be successfully applied to achieve excellent results in criminal justice systems, to not only to detect crimes but also to predict crimes to prevent them before it happens. On the other hand, the extended part of my research ran to another section which I thought of

measuring the ability and the possibility of applying AI in Srilankan criminal justice systems.

For that I have made a questioner. Its consisting of general AI related questions which was aimed for all the age ranges of Srilankan citizens. The main aim of the questioner was to get an idea about the current criminal justice system and to identify the need of applying AI to improve the traditional crime detection and prevention methods.

To gather information about the knowledge and interest of people based on collaborating Artificial intelligence with Criminal justice system, I made a questionnaire which is consist of 10 simple questions. The google form comprising of those questions were divided among both male and female respondents of various age ranges. Survey results are summarized below. From the first two questions respondents were asked to select their gender and the particular age range before answering the respective questions.

Google form was distributed among 105 people and among them 102 submitted their answer sheets.
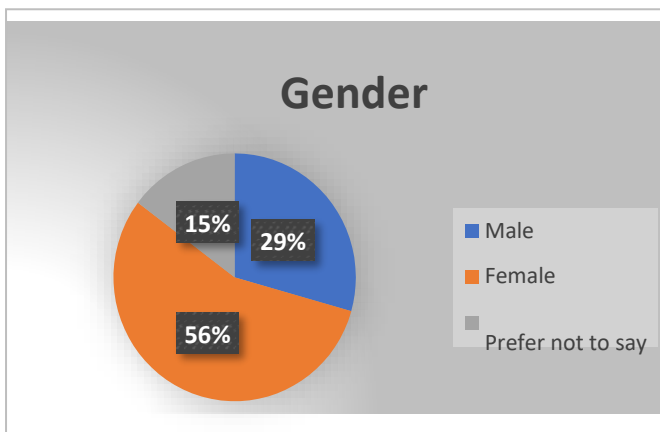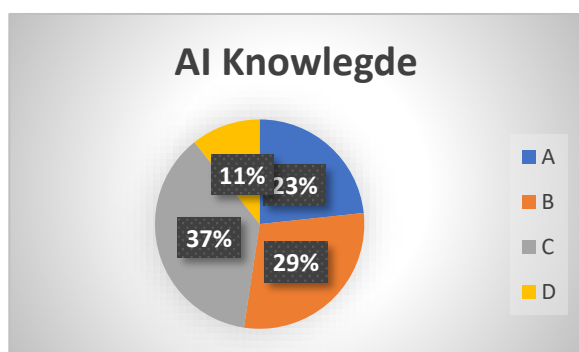

Figure 1: Result summary of Question 01

Figure 2: Result summary of Question 02

The next question was **Have you ever learnt, studied, or even heard about Artificial intelligence (AI) technology?** Four answers were given:

- A-Yes, I have learnt AI in School, in University as a course module
- B-self-studied that, so I have an idea about the concept
- C-I have heard the word Artificial intelligence, but I have no thorough idea on that field
- D-I have never heard about something called Artificial Intelligence

The aim was to get an idea about the AI related knowledge of people. Following is the summary of the results. 23% of the audience have a good idea about AI. And 11% of the respondents are clueless about AI. Most of the people in the particular audience (37%) are only farmiler with the word AI but have no through knowledge on that.
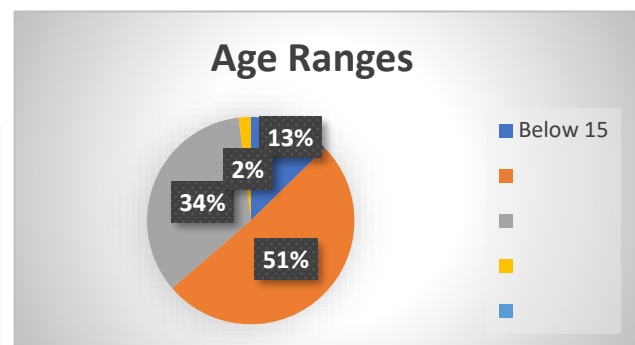

Figure 3: Result summary of Question 03

The fourth question was to get an idea about the knowledge that the particular audience has regarding AI Applications. The question was " **AI is a blooming field that is highly used to level-up the daily life of people mostly in first world countries have you ever heard about AI applications?**"57% them have heard about AI applications. Others aren't aware about AI applications. Starting from fifth question it was my aim to collect the ideas from the target audience criminal justice systems and about applying AI to it.
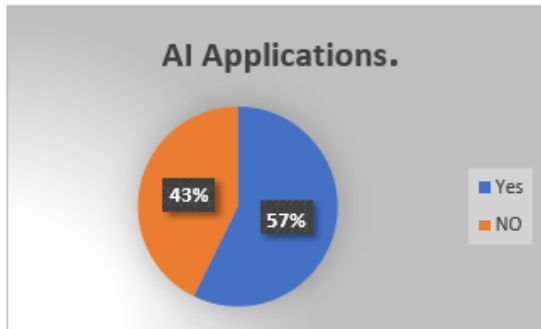
Figure 4: Result summary of Question 04

Figure 5: Result summary of Question 05

So, the fifth question was "**Are you aware about the criminal justice systems in Srilanka?** "This question was presented to the respondents to get an idea on how much of people in the society are aware, having knowledge or have studied about the criminal justice systems around the world. Three answers were given to select one among them. Yes, No and Up to a certain extent. Following are the results.

Out of the responses 25.1% do not have any knowledge about the Srilankan criminal justice system. But rest of the respondents are aware about the systems in SriLanka 64.% ha ving a thorough knowledge about the subject while 11.3% respondents are having the knowledge up to a certain extent.

The next question was Are you ever suspected of being involved for a crime when you had no part to play and are completely innocent? The aim of the question was to get a simple idea about how fair the judgments are given using traditional methods. Then I realized that there are people who have been suspected of crimes without no reason (when they are innocent) Out of the respondents 28.4% for suspected of crimes without any fair reason. So, it proof that there are errors in traditional system.
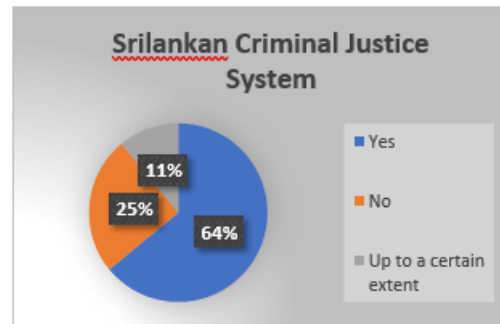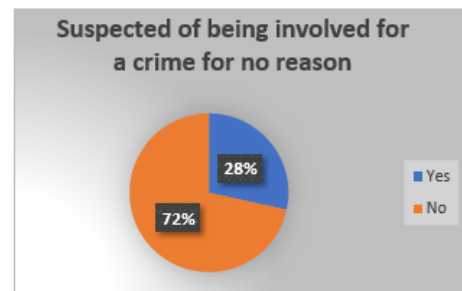

Figure 6: Result summary of Question 06

Seventh question was **Do you believe that the most accurate results can be obtained using the traditional methods of criminal justice?**

Results were as shown in the below pie chart. Most of the people believe that accurate results
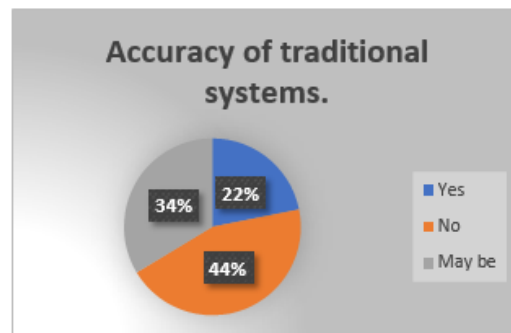

Figure 7: Result summary of Question 07

cannot be obtained using traditional method, 44.1% as a percentage.

The next question in the survey was **Are you satisfied about the current judicial decisions based on traditional crime detecting methods?** Aim of the question was to get an idea about whether the people are satisfied with the current judicial system.
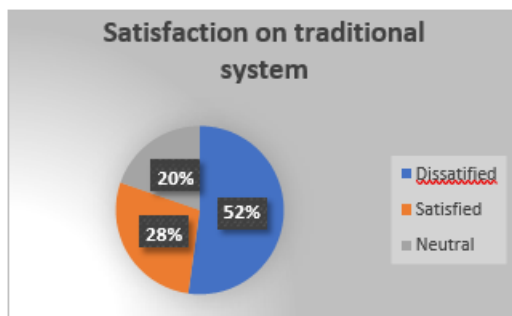
Figure 8: Result summary of Question 08

From the results gained through the survey I noticed that most of the people are dissatisfied (52%), and some of the respondents are very dissatisfied on traditional crime detecting methods. Only 28% from the sample are satisfied with the traditional methods of crime detection and prevention. So, it proves that a new method should be introduced for crime detecting.Then it was our aimed to count the people who are keen to work with new technology. The question was Rate how you feel about using of new technology in criminal justice beyond the existing traditional methods?

5-point Sd scale was given to the respondents. The answers were ranged from very important to Not important. Below is the result chart. From the result it's clear that most of the people are interested on using new technology to criminal justice system.
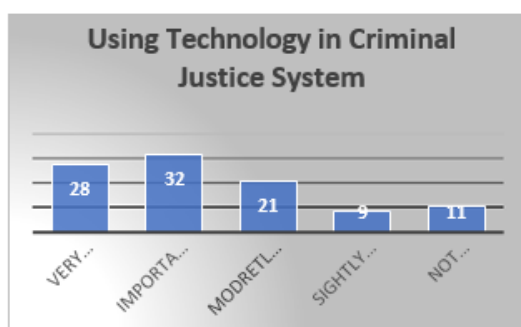

Figure 9: Result summary of Question 09

As the last question I asked respondents to **Briefly state their views on the use of this technology in Sri Lanka.** Following are some of the selected responses.

V. ANALYSIS OF QUESTIONNAIRE.

Every day holds the potential for new AI applications in criminal justice, paving the way for future possibilities to assist in the criminal justice system and ultimately improve public safety. Video analytics for integrated facial recognition, the detection of individuals in multiple locations via closed- circuit television or across multiple cameras, and object and activity detection could prevent crimes through movement and pattern analysis, recognize crimes in progress, and help investigators identify suspects. With technology such as cameras, video, and social media generating massive volumes of data, AI could detect crimes that would otherwise go undetected and help ensure greater public safety by investigating potential criminal activity, thus increasing community confidence in law enforcement and the criminal justice system. AI also has the potential to assist the nation's crime laboratories in areas such as complex DNA mixture analysis. Pattern analysis of data could be used to disrupt, degrade, and prosecute crimes and criminal enterprises. Algorithms could also help prevent victims and potential offenders from falling into criminal pursuits and assist criminal justice professionals in safeguarding the public in ways never before imagined. AI technology also has the potential to provide law enforcement with situational awareness and context, thus aiding in police well-being due to better informed responses to possibly dangerous situations. Technology that includes robotics and drones could also perform public safety surveillance, be integrated NIJ Journal / Issue No. 280 January 2019 9 National Institute of Justice | NIJ.ojp.gov into overall public safety systems and provide a safe alternative to putting police and the public in harm's way. Robotics and drones could also perform recovery, provide valuable intelligence, and augment criminal justice professionals in ways not yet contrived. By using AI and predictive policing analytics integrated with computer-aided response and live public safety video enterprises, law enforcement will be better able to respond to incidents, prevent threats, stage interventions, divert resources, and investigate and analyze

- Currently this technology is not using. So, it's better to involve AI in above field.
- Using AI security cameras to protect their assets
- We need to test how good that technology is. Then a conclusion can be drawn.
- I hope people are scared to move on to new technologies and new methods. We should only get the positive part and move on.
- Semantic web is all about focusing on web screening and metadata, easy findings from any site or system with digital footprints
- It will be helpful to all the people
- Technology will reduce the time taken to give away a judgement with equality to every citizen
- It will be good for Sri lanka.
- It is very good method
- For artificial intelligence technology to be used any field the gathered results should be accurate enough to obtain atlest 50% of the expected success of the particular project. So, in Srilanka it should be better if accurate results can be gained before starting the project.
- It will be good to have such a system. Using AI will be more accurate than existing systems
- AI will surely solve most of the problems in traditional methods
- It will be really beneficial to solve problems other than using traditional methods
  - It will be efficient and reliable

criminal activity. AI has the potential to be a permanent part of our criminal justice ecosystem, providing investigative assistance and allowing criminal justice professionals to better maintain public safety.

Extended part of my research ran to another area which I explored to gather information about the knowledge and interest of people based on collaborating Artificial intelligence with Srilankan Criminal justice system. Through that I found there are issues in the existing criminal justice system and most of the Srilankans in all age ranges without a gender difference believe that Artificial Intelligence could improve the current judicial systems.

V. CONCLUSION

We now live in an era in which artificial intelligence (AI) is a reality, and it is having very real and deep impacts on our daily lives. From phones to cars to finances and medical care, AI is shifting the way we live. AI applications can

be found in many aspects of our lives, from agriculture to industry, communications, education, finance, government, service, manufacturing, medicine, and transportation. ("Applications of artificial intelligence," 2020) Even public safety and criminal justice are benefiting from AI. For example, traffic safety systems identify violations and enforce the rules of the road, and crime forecasts allow for more efficient allocation of policing resources. AI is also helping to identify the potential for an individual under criminal justice supervision to reoffend. Through this research it was mainly focused about how AI can be used in criminal justice system. Crime predictions, crime detections and for crime preventions. And within this research I pay my attention on how current judicial system was before appreciating the role of AI in the judicial ecosystem. Then about the future of AI in criminal justice system.

My aim through this research is to let the Srilanka judicial system benefitted by new technology. Make the Srilankan criminal justice system more loyal and fairer to everybody who needs help

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