Deforestation Monitoring System (DMT) to Reduce Deforestation and Protect the Environment in Sri Lanka

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Abstract - Sri Lanka has a rich biodiversity distributed in a wide range of ecosystems such as forests, rivers, wetlands, coastal and marine ecosystems. Forest density in Sri Lanka was 82% in 1882 and has decreased by 65.5% over 137 years. It causes to climate changes, humidity, and CO2 emissions in the areas. The main reason is deforestation, which happens due to farming, wood cutting, and natural causes. Other reasons behind this are the lack of properly enforced laws and having lots of ways to mislead authorities due to the unavailability of a mechanism to monitor all the cases in one picture. Hence, the relevant authorities require the system to monitor this deforestation and identify law-breaking people to take proper legal action against them. To overcome these issues, Deforestation Monitoring System (DMS) has been proposed, which has Sawmills and Timber Depot owners, Grama Niladhari, Divisional Secretariat, Range Forest officer, and Legal Enforcement Officers. The Global Forest Watch online platform, location updates of system registered, and uploaded images are the main inputs of the proposed system. DMS is proposed to reduce law violators and increase responsibility, efficiency, transparency, and effectiveness among citizens. Further, the relevant laws and regulations should be revised to get the maximum benefits of this system for the advancement of the Sri Lanka's environment and society.

Keywords: Deforestation, Global Forest watch, Range Forest officer, Sawmills and Timber Depot owners

I. INTRODUCTION

Sri Lanka is a land of 65,610 km2 and it has a rich biodiversity. Its main ecological factor is the forests. Forests have different types, and we have highly protected forests and primary forests. In ancient times, people used to cut down trees for their crops, which caused minimal damage to the environment. The forest has been cut down 65.5% in a span of the last 137 years and depicts that the forest density in 1882 was 82% and in 2019 it was 16.5%. The factors may be the growth in population, construction of mega dams & highways and urbanization. Furthermore, World Food and Agriculture Organization rated Sri Lanka as the 4th country with the highest amount deforestation in 2010 and still Sri Lanka holds the same position even now [1].

Global Forest Watch, the powerful tool for mapping recent tree cover loss indicates the Primary Forest in Sri Lanka which is the most diverse form of forest lost 10.5kha of humid primary forest, making up 5.3% of its total tree cover loss in the same period (2002 to 2021) (Fig.1). In this period, the total area of humid primary forest in Sri Lanka decreased by 1.8%. Further, 9.0% of tree cover loss occurred in areas where the dominant drivers of loss resulted in deforestation. Further to that, tree cover lost 202kha of tree cover from 2001 to 2021, which is equivalent to a 5.1% decrease in tree cover since 2000, and 3.3Mt of CO_2e emissions to the environment. According to the above fact, we observed that deforestation is the critical factor that affects the environment, and it is getting worse in the coming years [6].
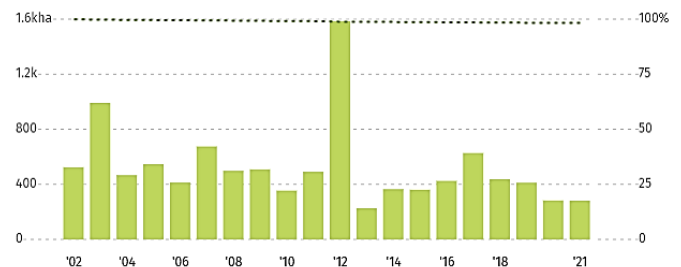

Fig. 1. Total loss of humid primary forest from 2002 to 2021.
Source: Global Forest Watch

In Sri Lanka, we should have a permit to cut and transport timber. This information is in Gazette No. 1548/29 of 09.05.2008 and No.1762/1 of 11 June 2012 and in Chapter V of the control of timber and forest produce in transit under Forest-Ordinance-No-16-of-1907. There is a current remote sensing approach to monitor forest degradation in support of countries measurement, reporting and verification (MRV) systems for Reducing Emissions from Deforestation and Forest Degradation (REDD+) [3]. Also, Norway's Ministry of Climate and Environment and the satellite monitoring group planet developed a system to anyone with an internet connection can now view monthly updates of high-resolution satellite imagery of tropical forests for free [2]. Further, Canada's National Deforestation Monitoring System (NDMS) was created and introduced to provide the information needed by Canada to meet its obligation under the United Nations Framework Convention on Climate Change (UNFCCC) to report the areas affected annually by deforestation [4]. Another one is IJATSCE (A Smart Deforestation Monitoring and Control System Model) system. It is a design of an intelligent framework created for deforestation detection and control systems. It is using machine learning algorithm and wireless sensor network for proactive and reactive measure [5].

All existing monitoring systems can identify deforestation, but there is no proper mechanism to involve all relevant stakeholders in the monitoring and decision-making process.

Therefore, it is very difficult to act against such violators. Sri Lanka still uses outdated laws & regulations and manual procedures to restrict deforestation. Hence, Sawmills and Timber Depot owners (SATD) can easily violate the laws and regulations they have agreed to carry out through the process of felling trees. The proposed system is introduced to streamline the existing outdated manual system.

II. MATERIALS AND METHODS

This proposed system will get all the relevant authorities to monitor, evaluate, and take decisions efficiently and effectively. This increases transparency, responsibility, and relationships among members. Also, all actions are recorded in the system which creates some reluctance for users to violate applicable laws and regulations.

A. User requirement

The system has different users who are divided into Administrator (System Owner), Monitoring Officers I (RFO and Law Enforcement Officer), Monitoring Officers II (Divisional Secretariat officer and Grama Niladhari) and other users (SATD and guest users). They have different levels of responsibilities and authority. SATD owners must register their timber transport vehicles with the system. SATD requests will be sent to the other members after mentioning the recommendation in the system. Grama Niladari (GN) should update the geolocation (Depending on the Mobile data coverage) and images of the locations requested and number of trees planned to be felled. Once this approval is received from an authorized officer, SATD owners are notified to proceed with the request. After they finish the felling of trees, GN should take images of the location and update the system with number of trees being felled. Also, the system has the facility to refer violations to the Law Enforcement Officer. Furthermore, they can check log transport vehicles on the spot at checkpoints with the help of this system.

Range Forest officers have details of protected forest and other information to consideration requests. Furthermore, they have access to the Global Forest Watch website view and get updates on tree coverage in the relevant area. Then they have peer observations of the locations and can make decisions about the forest cover. Also, this system has guest user access and users, those who want to protect the environment can be part of the system. They can upload deforestation cases to the system with the geotagged images. This can be considered when making decisions by the RFO. Therefore, this will minimize the escape points of the law violators.

B. System requirement

Existing deforestation monitoring systems are focused only on monitoring of deforestation and there is no mechanism to reduce deforestation. Therefore, the system is proposed to bring simultaneous decision-making as well. This application has mainly three parts (Web portal, Database, Mobile Application) (Fig.2).

Web portal has registration, login, request, view, and recommendation pages for different users. All these activities can be done by this web portal. Also, mobile application was developed for easy access to the system users.
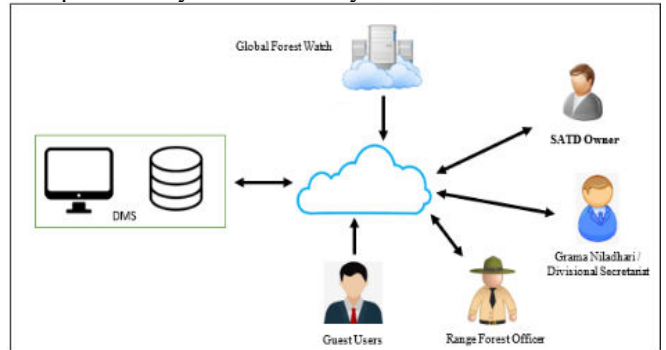

Fig 2: Top Level Diagram of proposed System

III. RESULTS AND DISCUSSION

The proposed DMS is developed using HTML, PHP, MySQL, CSS, JavaScript, JQuery and WSDL. GN is the key role of the system, and they must upload location images in the initial and final stages of requests to the system. This image can be uploaded to the system online or offline with a geotags and date stamp. Then RFO can then refer to global forest watch and related satellite images to analyze the specific location. All the activities and decisions will be displayed and will reduce the possibility of misleading the relevant authorities. We can provide a Global Positioning System (GPS) for the timber transport vehicles, which will help track their location. This is not easily implemented due to financial limitations. Furthermore, we suggest that providing system access to the public (citizens) will increase system efficiency. Because they can upload deforestation cases and these cases can be taken to the decision-making. Also, if any cases are illegal, they can be referred to the law enforcement officer for legal action. Further, it is proposed to enact rules for SATD holders to plant large number of saplings in selected areas for forest felled trees to maintain tree cover in Sri Lanka. It will improve air quality, mitigate climate changes, enhance biodiversity, maintain water quality, enrich soil fertility.

IV CONCLUSIONS

Implementation of this system is the involvement of good citizens and authorities to change the existing outdated mechanism related to felling of trees for business purposes. The system is cost-effective and uses minimum technical and maximum user involvement to operate. All the users/activities can be monitored and it creates transparency, efficiency, and effectiveness among the relevant stakeholders. Further, the laws and regulations relevant to deforestation, felling of trees, and issuance of permits for SATD should be updated to get the maximum benefits of the system. This approach can be used to streamline similar public services and systems. The ultimate goal is to create a law-abiding society and protect the environment in Sri Lanka for a better future.

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