Theme – Natural disasters prediction/prevention

PROBLEM – LANDSLIDES

- ## Why is it important to solve the problem?

As most of us live in or are related to the state of Himachal Pradesh, it has been observed that continuous landslides have been a major issue for public as well as the authorities. Himachal Pradesh being a tourist hub has almost ***887 roads, including 13 national highways*** and hence the vehicular traffic is increasing. This results in various problems being it from ***loss of lives and property***, to extreme traffic jams on the highway and various sort of discomfort for the public (local as well as tourists). Sudden landslides ***block the roads and huge traffic jams*** are caused which further makes it difficult for the ***emergency and road clearance vehicles of PWD and NHAI*** to reach the spot.

The following data depicts the ***landslide prone areas*** in Himachal Pradesh ***district wise in Sq. Km.***:

District	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una
Total Area	1142	6370	1100	5611	6322	5401	13591	3870	5019	2742	1910	1508

Not only in Himachal Pradesh, but the ***problem is faced in many states*** and hence needs to be solved in order to improve road transportation, save lives and property and for an overall improvement.

What has already been done by others globally to solve the problem?

Natural calamities are a concern which has alarmed whole world. Administrations from all around the globe have been continuously working to find an ultimate solution to various natural disasters in order to ***either prevent them or reduce their damage.***

In order to prevent landslides, various countries have worked on ***providing better drainage in the hills and constructing tunnels*** instead of open roads. But these steps might prevent landslides to certain extent but still the enormous number of unpreventable landslides happening all around the globe needs a better solution for ***real time monitoring*** of landslides.

One such step towards the same has been observed in the ***Unites States of America.*** The ***USGS (United States Geological Survey)*** has operated near ***real-time hillslope hydrologic monitoring stations*** in several locations across the continental U.S. for about 10 years with the goal of eventually establishing an ***early warning system for debris flows*** in cooperation with the National Weather Service. The current sites are located in Oregon, California, and North Carolina. The stations monitor rainfall and track the amount and movement of water in the upper few meters of the hillside. Some also have ***instruments to detect ground movement indicative*** of landslides. Most of these stations are operated in cooperation with universities, state and local government agencies or other partners.

What solution is proposed by the team?

We have come up with an idea and have ***successfully created and tested a working prototype***:

Smart Landslide Monitoring System (Using Arduino and IOT)

The solution is divided into 2 stages:

1. Pre - landslide monitoring

A module consisting of a ***soil moisture sensor and an accelerometer*** can be placed at frequent distances in the landslide prone areas along the highways. This module can help sense the excessive moisture and unequal vibration in the

mountains and can ***give alerts to the authorities*** about the expectancy of a landslide. Once getting alerted about the situation, the concerned authorities can prepare for any sort of occurrence and various departments in that areas can be put on standby to ensure quick action.

Soil moisture senor ***continuously monitors the water level in the soil.*** It can help by informing hazardous water levels in the soil which causes loosening in the soil bed and landslides are caused.

An accelerometer ***senses the movement and vibrations in any substance.*** In the beginning phase of a landslide, the rock and soil particles start to vibrate and rate of movement increases. Hence it can help by informing unusual motion.

Both the sensors will further be joined to an ***Arduino board along with an GSM module*** to send alerts directly to the mobile phones of the concerned authorized people. Continuous electric supply can be provided through ***solar panels.***

2. Post - landslide monitoring

A module consisting of an ***ultrasonic sensor*** can be placed at frequent distances in the landslide prone areas along the highways. This module can help detect the occurrence of a landslide by sensing the falling rocks and soil particles and can ***give alerts to the authorities*** about the occurance of a landslide so that road clearance vehicles and traffic police can come in action quickly and prevent huge jams.

An ultrasonic sensor ***detects any obstacle coming into its path*** and can hence easily detect landslides and send immediate alerts.

Both the sensors will further be joined to an ***Arduino board along with an GSM module*** to send alerts directly to the mobile phones of the concerned authorized people. Continuous electric supply can be provided through ***solar panels.***

This module as a whole can prove to be an amazing solution towards landslide detection and prediction processes. Installing such modules is beneficial as they won't cost much, will consume less power, are easy to maintain, provide fastest and real time landslide monitoring and hence help save lives, property, resources and time.