International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-4, February 2020

Role of IoT devices in Flood Monitoring System using Social Networking Sites

Himanshu Rai Goyal, Kamal Kumar Ghanshala, Sachin Sharma

Abstract: Each country has a natural disaster, but catastrophe losses can't be avoided. The loss of human life, damage to the environment, infrastructure degradation, etc. Which in turn affects the country's development facing the disaster's wrath? In this analysis, we discuss the various methods available in the literature to reduce the losses in flood-related natural disasters. There are four major steps in the prevention of disaster losses, including preparedness, response, recovery and mitigation. Existing methods that address the above steps and all the current methods have certain limitations and are therefore not all sufficient to minimize losses due to flooding. In order to overcome all the deficiencies in the exit method, we propose an IoT devices based algorithm to get the number of victims and survivors due to flood and reduce the flood losses model using social networking sites.
Keywords: Natural disaster, floods, Social networking sites, Community, Statistical data, IoT.

I. INTRODUCTION

Natural disaster is an event that occurs without the involvement of human beings from the natural calamities of the Earth, such as floods, cyclones, earthquakes, hurricanes, volcanic eruptions, etc. The consequences of a natural disaster are not good at all because many lives are lost, infrastructure damage, and financial losses [1]. Bharuch, on 3 August 2004 Gujarat flood damage is estimated 350 kms. of Panchayat Roads, costing round rupees 9.44 Crore. The losses range from 50,000 to 100,000 crores in 2006 and in 2006 in Bhopal, Surat and Vishakhapatnam and also in 2015 in Chennai. The auto industry loss was estimated at approximately 8,000 crores as a result of the flood. In Saidapet, 2000 huts have been destroyed by flooding, 540 people killed and 18lakhs have been displaced from the same area affected by the floods on 10 December [2].

Revised Manuscript Received on February 28, 2020.
* Correspondence Author
Himanshu Rai Goyal*, Department of Computer Science and Engineering, Graphic Era Deemed to be University, Dehradun, India. Email: himanshugoyal19@gmail.com
Kamal Kumar Ghanshala, Department of Computer Science and Engineering, Graphic Era Deemed to be University, Dehradun, India. Email: kamalghanshala@gmail.com
Sachin Sharma, Department of Computer Science and Engineering, Graphic Era Deemed to be University, Dehradun, India. Email: sxsharma88@gmail.com

Disaster in India is further compounded by uncertainties linked to demographic change, environmental degradation, climate change, and so on, which have led to a serious situation threatening the country's economic growth.

Urbanization in India is much faster than any other region, and the urban floods have caused more damage in recent years. The floods are mainly due to unplanned urban building and development. In addition, fertile land is transformed into urban infrastructures and unsuitable drainage systems. In the rainy season the water level is higher. The maximum damage is caused by this water.

Infrastructure damage caused by urban flooding, economic losses. Urbanization gradually grew from less than 25% in 1970 to more than 50 percent in 2006 in developing countries. By 2020, Asia is the tenth largest economy and one of the world's fastest developed areas. According to a number of surveys in 2000, 37% of the people lived in urban cities and by 2025, the proportion is expected to be higher than 50%.

Natural disasters arrive without any warning and take the lives and financial and environmental failures of millions of people. In the coming years, the rate of natural floods over line with the previous conditions will increase very significantly. It is therefore critical that we adapt to the changing environment and find ways of avoiding and managing ourselves and our environment in times of flood. The collaborative and dynamic social network used to connect IoT sensors. The sensor gathers and analyses data. This data was collected to support the management of floods and crises. Gubbi et al. offers a cloud-centred view of IoT. al. they use interconnected, sensible, cloud-based networks and seamlessly integrated history and new features to provide access to rich flood-related information [9]. Perera et. al. investigation of the use of the sensor in a service model in technological and so on in identifying the major challenges and issues. Explored this concept as a service and how it fitted with the Internet of Things. IoT technology could be used to implement a concept of the smart city but there were a few technical challenges like communication between heterogeneous devices etc [10].

Poslad et. al. proposed an IoT EWS framework that addressed the analysis of sensitive data timely, exchange and processed the need to changing ICT for resilience at resource constraint in crisis zones based upon a multi semantic representation model to enhance the rich [11].

Sahkardande et. al. proposed an interconnected module of the smart system and which helps in building a central data acquisition system as well as to provide a loop of the interconnected network for transmission of data in the absence of any existing infrastructure.

This approach uses microcontroller controlled sensors, actuators, and a Wi-Fi transceiver module, connected to zinc batteries for data acquisition of that area. This concept we can call smart city model in flood management, but in real life scenario, it is not possible to achieve [12].

Mitra et. al. proposed an integrated model of an embedded system with IoT and machine learning-based to predict the probable floods in a river basin. [13].

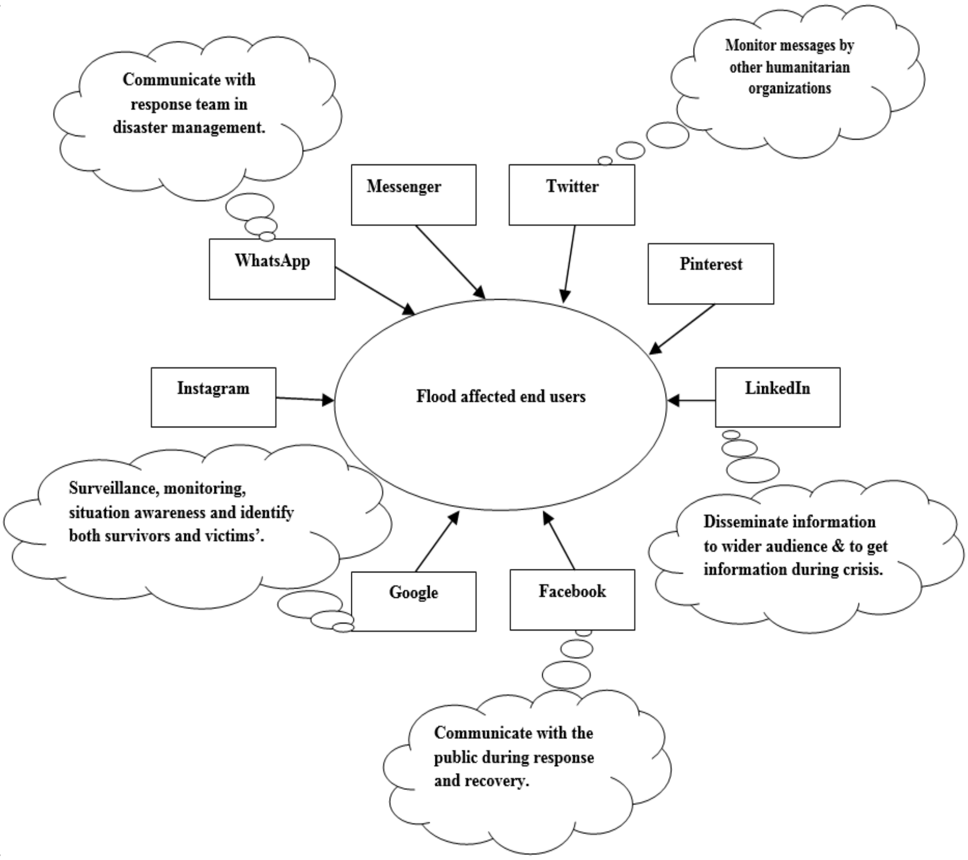

Fig. 1. Role of social networking sites during flood.

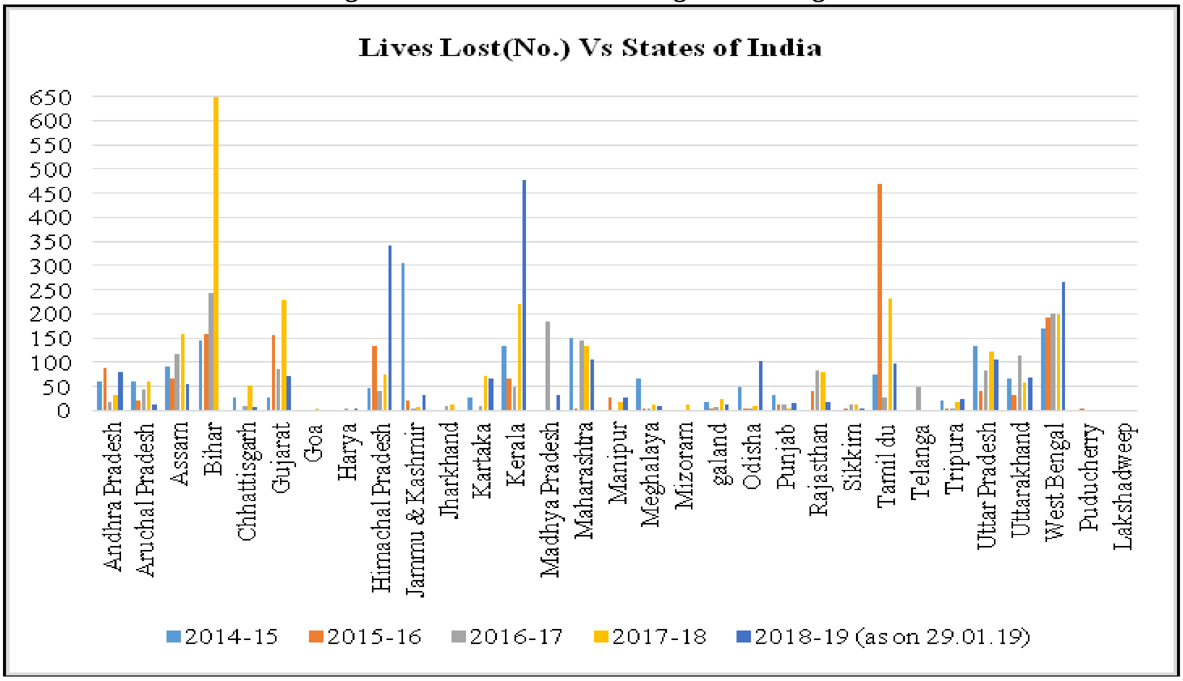

Fig. 2. Lives lost vs states of India.

Bande et. al. proposed a method to monitor humidity temperature, pressure and also to find their correlative information during flood prediction analysis [14].

Kamruzzamman et. al. discussed IoT and provided a solution for post-flood. A small application was there on all mobile phones. As and when the traditional cellular network got lost for some time the application was triggered for D2Dcommunication which might have been called a beacon interval till the restoration of the traditional network [15]. Suici et. al. proposed a software framework to achieve a self-adaptive critical interactive cloud-based model used during flood early warning using IoT [16]. Xiaolong et. al. discussed the concept of the systematic evacuation of a large group of people. It was called the evacuation planning model for a large group of people during floods [17].

The main objective of this study is to examine the methods / technologies and their shortcomings in the current scenario. A novel way to resolve these limitations is proposed.

The following paper is organized as follows: Section II explores the existing method for flood management. Section III illustrates floods data analysis in Indian states. Section IV explains the proposed model implementation and result analysis and section V explores the conclusion.

II. METHODS USED

The methods used to prevent the losses during floods are mainly divided into:

- Social Media
- Community
- Statistical data analysis
- Geographic Information System (GIS)

Social Media: Social media has been a new, important technology to respond to catastrophes in recent years and is an important tool for online information sharing through interaction between people. Social networking sites serve as a medium for worldwide data exchange. By uploading images, commenting on comments, or chatting, users interact with each other. Social media allows users to interact by social communications, emails, one-to - one feeds, one-to - one and multiple communications. It is easy to distribute information. Events in real time, live chats, and videos are an easy way for the user of their phone screens or computers to become enthralled. During the tragedy, interacting with friends and family members is hard for people. Persons in the disaster area often need travel, food and shelter information in order to stay safe. Social networks help to communicate globally with the external people and the needy by exchanging data. People affected by or stuck in natural floods can easily get help from their social media accounts. There are many social awareness groups and charities on social networking sites which are prepared to pursue projects to help the needy and to seek help from other people and the state in the event of an emergency.

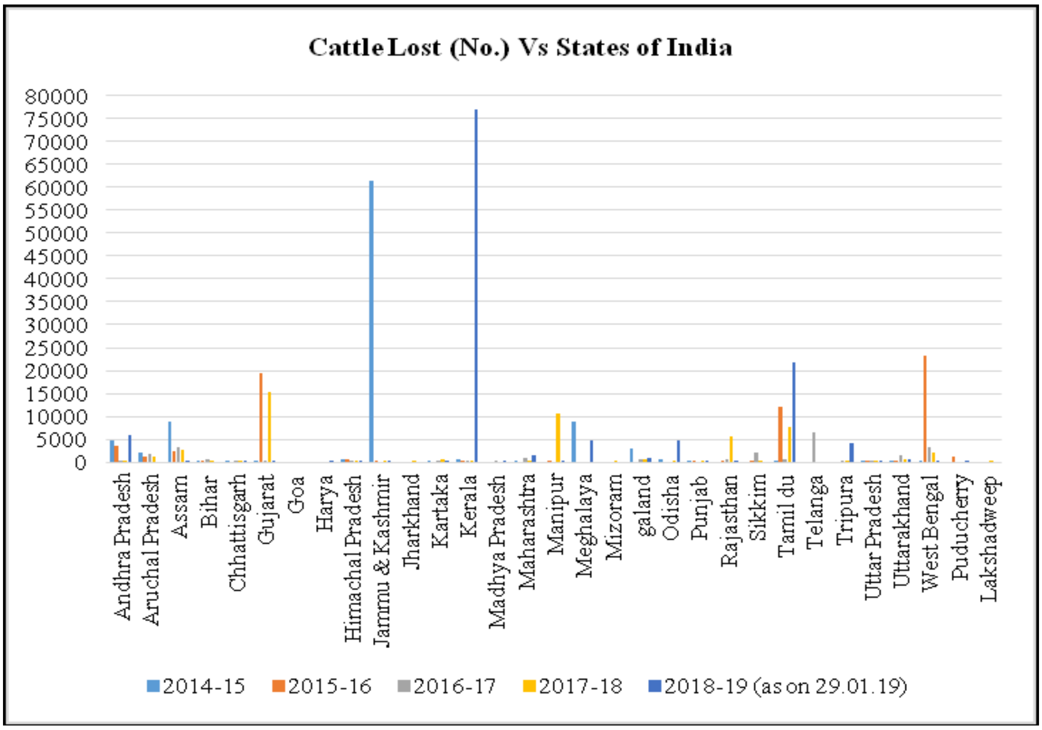

Fig. 3. Cattle lost vs states of India.

Many websites such as Facebook ask people to "send themselves as safe," so they can get to know the safety of your family and friends.

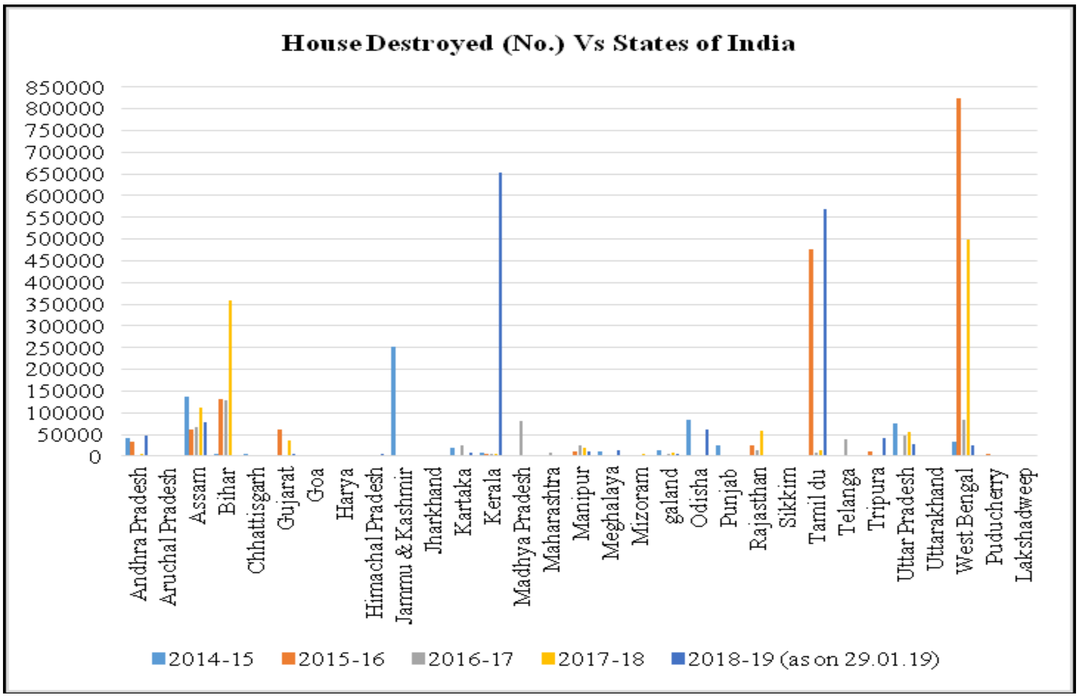

Fig. 4. Houses destroyed vs states of India.

The information shared in social media is sometimes not 100% accurate. People share false things in order to gain publicity and attention. Social networking sites do not guarantee if the generated account is a true or a fake one.

Therefore, monitoring social media data is important. For sending an emergency message to the public SOS and ESA are using social media and SMS.

The following flood control solutions can be beneficial in the social media:

- Valuable information can be given through social networking sites and SMS alerts in the flood zone, before and after the flood.
- It is possible to generate volunteers and to reach people willing to give money or food in support of those affected.
- This helps connect family and friends who have been displaced.
- In the worst cases, details about the property not already reported can be found.
- Those who have suffered will receive help, food and other services.

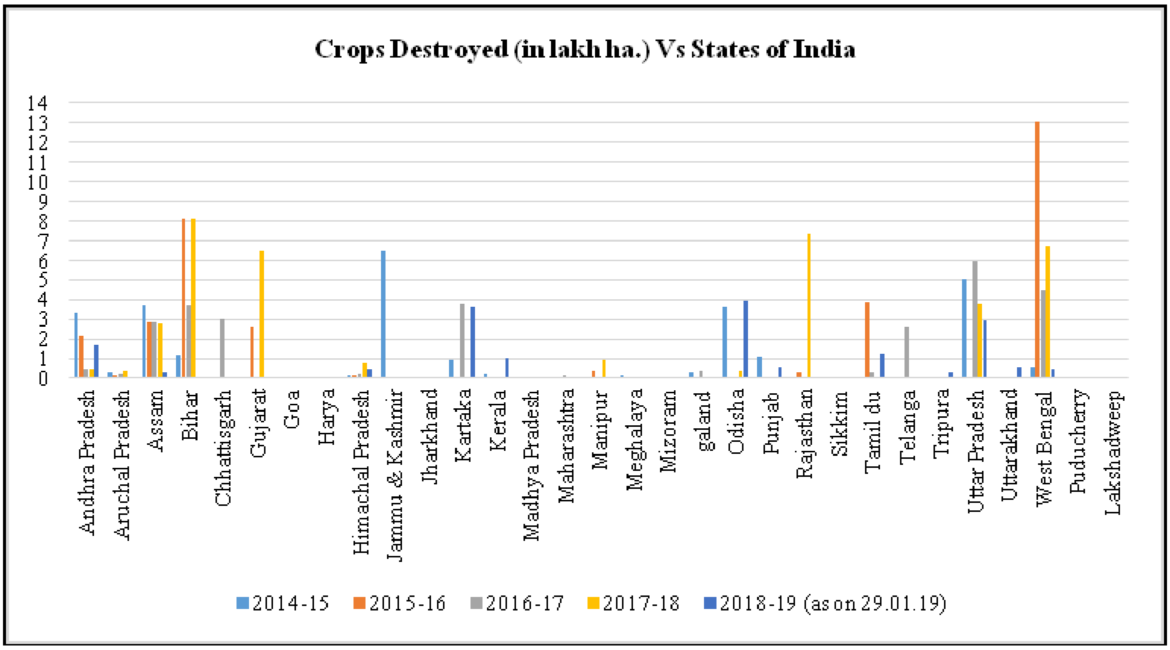

Fig. 5. Crops destroyed vs states of India.

Fig. 6. Flood affected area in Kerala during august 2018 (aerial view) [19].

The popular social network sites used to update the situation after natural strikes, such as roads, infrastructure, people, fires, accidents, deaths, power outages and other similar problems, are Facebook, Instagram and Twitter. Facebook. The knowledge of the public is promoted by television, radio and telephone. There are myths that mislead people about ongoing events when knowledge is misconstrued. This often leads to confidential information losses which allow victims to suffer for a long time as they are unable to learn about revised safety measures, aids and other resources necessary for flood survival. This leads to a chaotic state.

Through transmitting information on the area and people concerned in real time and receiving data from a flood zone, the power of social media is used effectively.

During the creation of electronic emergency networks, we must be vigilant about various issues like software glitches, malware, stalkers, hackers, burning, and faulty data flows. Fig. 1 shows the role of social networking sites during flood.

Community*:* A community is an independent body that has played an important role in preparing, responding and recovering floods. In this research we illustrate the role of the group and the various theoretical models through decision-making on floods. The community is a group of people. People make choices on a daily basis, but decision making during a natural flood is different and has serious effects on people and communities. We focus on the importance of community participation in flood planning, reaction and recovery and we also explore the possible role of a group in the conceptual frameworks used in flood decision making. These conceptual formworks which exist currently in the literature related to Hurricane Katrina.

Overview of Conceptual models: The conceptual models related to community are discussed under following:

- **Risk Perception and Vulnerability model:** This model has been developed by Smit et. al. that requires populations in present and future circumstances to recognize the threat and vulnerability. This model addresses the group and its workflow as per the given scenario. The data flow from the lower level (individual community) to the upper level is why they call this a "bottom-up" approach [3].
- **Chen's model**: It incorporates community-based flood control that provides information about perception of risks and flood preparedness [4].
- **Evacuation and Action Model:** This model eliminates the deficiencies in the Smit et model. Al. the integration of all of the required functionalities included in the framework is this model. These include socio-economic elements, the trust of authorities and interaction and so on in the preparation of the required deconstruction actions [5].
- **Flood Recovery Model:** Some research has to do with the recuperation of floods. Some people are suggesting so many theoretical models. The first model used for the recovery of floods which was discussed earlier involves knowledge of human behavior, in the conceptualization of management and assessment of psychosocial needs after flood [6] The above models offer a variety of conceptual frameworks, but fail to explain the nature of how the flood happens. Nevertheless, these template principles are not, every time the flood pattern shifts.

Statistical Data Analysis*:* This approach is used in order to predict the flood cycle and to calculate damages following the flood. The researchers are proposing new models based on statistical data using the available flood-related data. The model uses multiple statistical models and is used for data analysis [7]. Often during the flood, this model fails to address the key problems.

GIS: Satellite images are used to access information about flood damage. Most researchers offer different models. Such works focus mainly on the study of the collected images. GIS data are too broad and need smart device architecture [8]. GIS information is too growing.

III. FLOODS ANALYSIS IN INDIAN STATES

The floods caused damage to any countries growth. The following description will give insight into how floods affect not only human life but also the whole place where floods affected.

The data of all the states of India and 2014 to 2019 (January) [18] (Fig2, Fig. 3, Fig. 4, Fig. 5). From the figures below we can observe that the states which are near the river bed, Hilly area and near the sea are prone to floods as compared to any other states.

Fig. 2 shows the losses due to floods in terms of states versus the states of India. Sikkim, Kerala and Assam are the states which are more affected due to floods.

Fig. 3 shows the losses due to floods in terms of cattle lost verses the States of Indian. Himachal Pradesh, Kerala and Tamilnadu are the states which are more affected due to floods. Fig. 4 shows the losses due to floods in terms of Houses destroyed versus the states of India. West Bengal, Sikkim and Kerala are the states which are more affected due to floods. Fig. 5 shows the losses due to floods in terms of crops destroyed versus the states of India. Because of crops lost that affected the food supply in the country. With this economy also gets affected. West Bengal, Bihar and Rajasthan are the states which are more affected due to floods.

If we observe the severity of floods we can conclude that the reasons for floods vary from time to time and place to place based on the geographical and socioeconomically facts will also contribute more.

Case study on Kerala flood: In this section, we are discussing Kerala floods on August 2018 the aerial view of flood affected area is showed in Fig.6, The state of Kerala is known for 100% literacy and is located southwest of India's Malabar coast. This state is known for its natural beauty, tea and coffee groves. It's one of the country's best tourist spots [20]. Every year 1649.55 mm in Kerala rainfall was recorded in the Indian Meteorological Department but the rainfall in August 2018 amounted to 23.46.3 mm. The rainfall in August was 2,5 times higher. Between 1 to 19 August 2018, the state received rainfall due to spell of low pressure over that region and that time rainfall was 758.6mm as compared to the average rainfall of 287.6mm or 164 percent more [20]. This was 42 percent more than the rainfall in the entire monsoon season. Because of this the state under worst floods in 100 years. Many people have died under debris caused by landslides. More than 1 million people were left homeless. As per the estimation, more than 83,000km of roads and the estimated cost for recover were about 2.7 billion dollars [20]. Indians from dFifferent parts of the country took social media to response to floods and the Government also sent NDRF and SDRF for the recovery in response to the flood. They supplied medicines, drinking water and food to the people affected in this flood.

IV. PROPOSED MODEL IMPLEMENTATION AND RESULT ANALYSIS

Our proposed model is an optimized model. In this case, if the initial our proposed IoT model was implemented, so many lives could have been saved. Each district in the state, for example, now has a base station and this is linked by communication devices and sensors to all villages in that area. The base stations are connected to the centralized flood control operations center to function in real time. This model is validated for any scenario as explained above because it has been developed so that this model is prepared, reacted, recovered and alleviated in these four steps.

When we built this architecture for the proposed flood system model. How do these models contribute to filling the gap in the current model? If the losses are reduced, how much does this template help reduce flood losses? Does this model work?

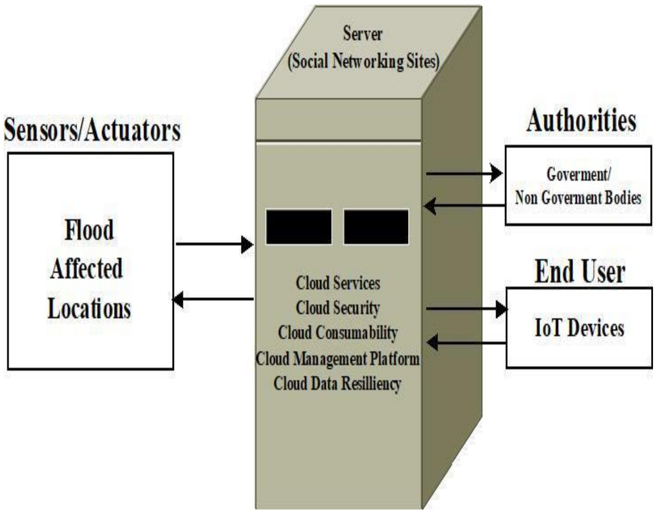

Fig. 7. Proposed model.

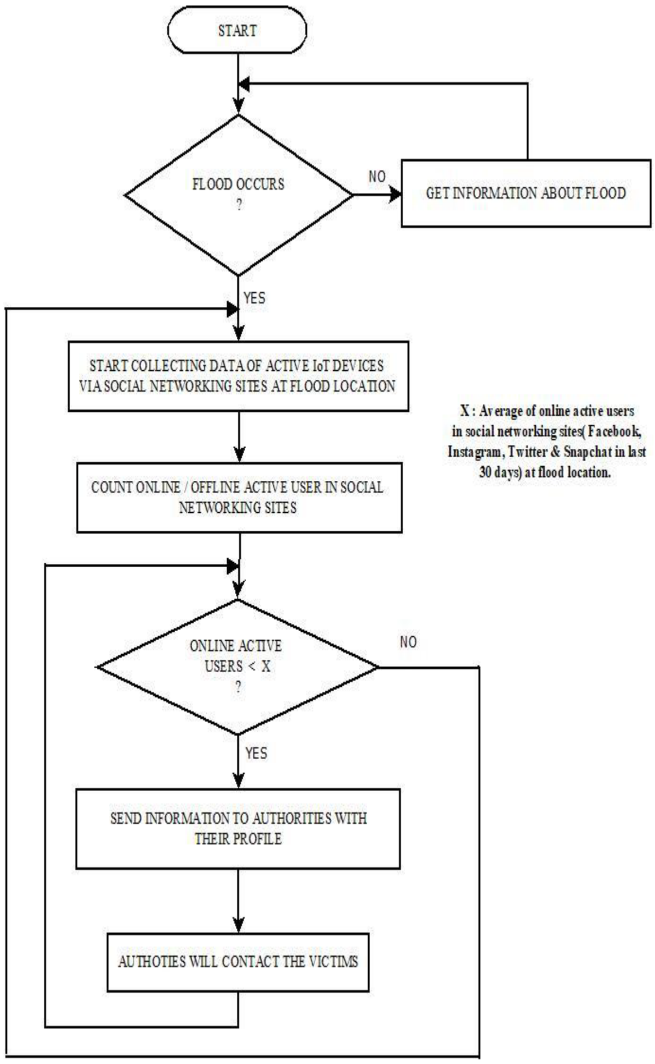

Fig. 8. Proposed model algorithm

Fig. 7 shows the IoT based model in flood scenario. In various places such as river bed, sewage line, every building, hospitals, offices and the municipal corporation specific sensor and actuator are built. Where the water level rises in the river due to heavy rain or for any reasons, the sensor sends information to the base station where the local data have been collected. Data will be forwarded from the different base stations to an integrated flood management operating center and a decision will be adopted on the basis of the data and alert messages will be sent to every base station. The base station sends an alert, together with hospitals, municipal authorities and so forth, to every individual citizen in the region to prepare for evacuation. All these systems are managed continuously in real time by the unified flood control operating center which is responsible for access the social networking sites data at the flood affected locations.

The model proposed includes all traditional methods. Under the following headings, how this proposed method helps prevent losses.

i. Preparedness: The equipment and sensors are installed in critical areas such as reservoirs, main water pipes, etc. It is connected to a control system that enables the valves to drain excess water in these vital areas. The control system is simultaneously connected to the main server. This server transmits messages or warnings to people / citizens and stakeholders in the area / place of the flood shown in Fig 7.

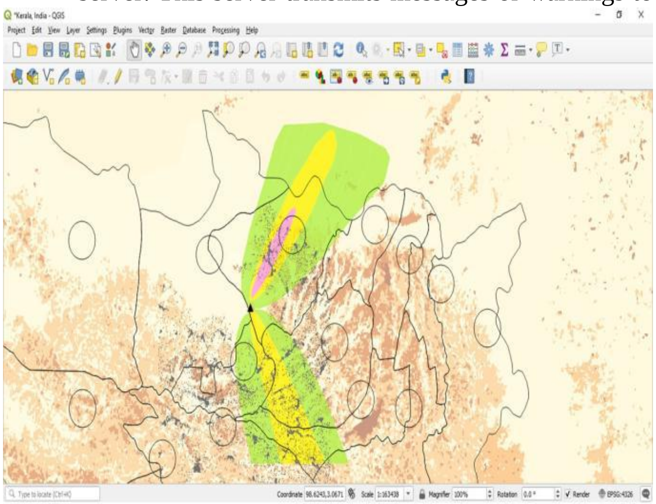

Fig. 9. Proposed model simulation on QGIS.

ii. Response: The system is enforced through a single local information platform, with stakeholders such as private agencies such as NGOs and government bodies consisting of weather forecasting. The information is also circulated by social media to individuals in this area, etc. The Optimized Service Portal provides information about the safe area through connected devices such as consumer appliances, and medical devices, etc. Where people are safe and can access basic facilities such as food, and water etc. The individuals and investors during floods have easy access to these protection areas.

iii. Recovery: Providers such as Hospitals, Municipal Corporation and NDRF are together with the government and some private institutions. The integrated network platform manages all these service providers. The internally managed to respond quickly to the flood situation by the central unified portal. The equipment that is connected to all service providers and people in the field impacted by the floods. For example, the house floods as a result of the flood and there is a home automation device that informs service providers how many people are inside and so on so that they save people's lives.

iv. Mitigation: This phase usually gives people information about the location of the flood and how long the flood will affect that area. In turn, we tell them how much time it will take. In this case, the stakeholder plays a major role. Take people to safe locations where the rain does not harm them.

Fig. 8 illustrates the proposed model algorithm. This proposed algorithm start working when it senses the flood at any geographic location.

1. Begin
2. if (flood occurs) then
3. Collect data of active_users
4. Count online_active_users, offline_users in social networking sites
5. if (online_active_users < X) then (Where X is average of online active users in social networking sites (Facebook, Instagram, Twitter and Snapchat) in last 30 days at flood location)
6. Send information to authorities with profile
7. authorities will contact the victims
8. go back to step 5 until authorities make contact
9. else
10. go to step 3
11. else
12. get information about flood until flood occurs
13. stop

Fig. 9 illustrates the proposed model simulation on QGIS (A Free and Open Source Geographic Information System) where flood scenario has been simulated.

Fig. 10 illustrates the number of active users on four networking sites (Facebook, Instagram, Twitter and Snapchat) vs flood affected location. We observed that in L1 (flood affected location) most of Facebook users were active compare to other social networking sites and in L2, most of twitter users were active, compared to others sites. We also observed that at location L3, very less number of users were active in social networking sites. So, we can predict that more number of people were affected due to the flood at the location L3.

Fig. 11 illustrates that no. of active users of different age groups on four networking sites ((Facebook, Instagram, Twitter and Snapchat) vs flood affected locations. We observed that age group (16-30) people were active at L2 and at L4, age group (31-45) were more active in social networking sites. From fig. 11, we can assume that L3 was affected more due to flood and it affected almost all age groups where we found less number of active users compared to other locations.

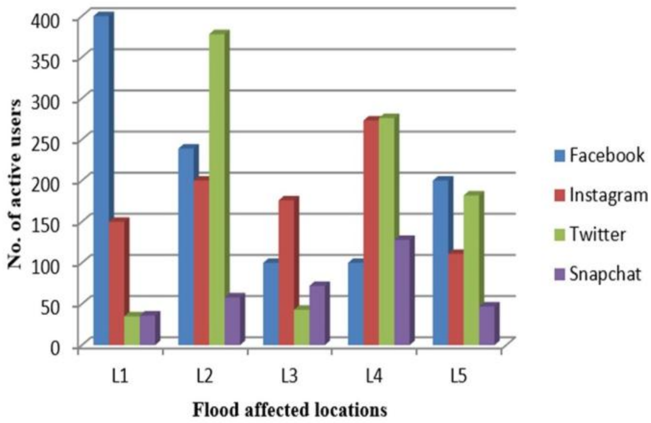

Fig. 10. No. of active users on four networking sites vs flood affected location

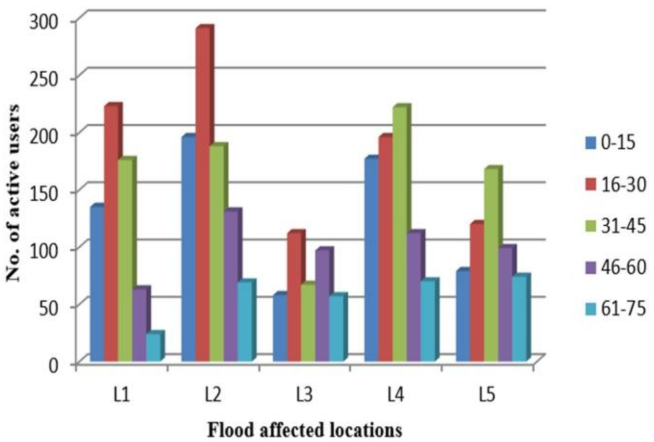

Fig. 11. No. of active users (Different age groups) on four networking sites vs flood affected location.

Table I illustrates the comparisons of existing models with proposed model, in this summary, we considered the Steps in flood management (SFM) as key parameters in evaluating these methods. During floods, the society plays major role to help people during different disaster situations such as flood. The most important thing is to support or contribute in the situation of flood that victims have needed. Analysis of statistical data is another method for the management of floods which is dependent on the previous year data. It is not very efficient for flood management in real time.

Table 1: Comparative analysis with proposed methods

Methods	Steps in flood management (SFM)			
	Preparedness	Response	Recovery	Mitigation
Social Media	X	X	√	X
Community	√	√	√	X
Statistical data analysis	√	X	√	√
GIS	√	√	√	X
Proposed Model	√	√	√	√

GIS has an important role and the issue is that all the countries do not have the efficient satellite or satellite communication. Although it is difficult to store and evaluate the required information quickly due to the large data is collected from the satellite. The proposed model is designed to achieve minimal losses during the flood situation in the flood management system. This model incorporates all models into the single model and is based on IoT. The system uses all the information required for real-time databases, which is processed so that the model is fully prepared, reacted, rehabilitated and mitigated for the four steps.

V. CONCLUSION

This proposed model helps to avoid or minimize losses during floods. The severity of the flood changes sometimes as the flood structure needs to be changed, but what usually happens with these losses is more than that. We therefore needed to develop a process or model to resolve the gaps and deficiencies in the existing methods. We proposed the IoT based model to manage the flood scenario. This approach is an interlock scheme in which the other service provider can take care of different services that can be controlled both locally and nationally if any of the service providers fails to respond to the vital flood situation. This proposed method performs better than any other existing method.

ACKNOWLEDGMENT

Authors would like to thank Mr. Nithin Kumar K C, Assistant Professor, Department of Mechanical Engineering, Graphic Era Deemed to be University, Dehradun for the guidance.

REFERENCES

1. Piyoosh Rautela, 16/17 June 2013,Disaster of Uttarakhand, India, and lessons learnt, Centre For Disaster Management, LBSNAA, Mussoorie, Disaster - Response and Management Journal, Vol 4, issue 1, pp 42-70.
2. Georges Ramalanjaona, Impact of 2004 Tsunami in the Islands of Indian Ocean: Lessons Learned, Emergency Medicine International, Volume 2011, Article ID 920813, 3 pages doi:10.1155/2011/920813.
3. Kasperson, R. E., Ortwin, P., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J. X., and Ratick, S. _1988. “The social amplification of risk: A conceptual framework.” Risk Anal.,82, 177–204.
4. Lemyre, L., Clement, M., Corneil, W., Craig, L., Boutette, P., Tyshenko, M., et al. (2005). A psychosocial risk assessment and management framework to enhance response to CBRN terrorism threats and attacks. Biosecurity and Bioterroris: Biodefense Strategy, Practice, and Science, 3(4), 316–330.
5. Renn, O., Burns, W. J., Kasperson, J. X., Kaspserson, R. E., and Slovic, The social amplification of risk: Theoretical foundations and empirical applications.” J. Soc. issues,48 (4), 137–160.
6. Bouwer, L.M., Bubeck, P., Wagtendonk, A.J., Aerts, J.C.J.H., Inundation scenarios for flood damage evaluation in Polder areas. Natural Hazards and Earth System Sciences, 9, 1995-2007.
7. Perry, R. W., and Lindell, M. K. _1991_. The effects of ethnicity onevacuation decision-making. Int. J. Mass Emerg. Disasters,9(1), 47–68.
8. Zelenkauskaite, Asta, Nik Bessis, Stelios Sotiriadis, and EleanaAsimakopoulou. "Interconnectedness of complex systems of the internet of things through social network analysis for disaster management." In 2012 Fourth International Conference on Intelligent Networking and Collaborative Systems, pp. 503-508. IEEE, 2012.
9. Gubbi, Jayavardhana, RajkumarBuyya, SlavenMarusic, and MarimuthuPalaniswami."Internet of Things (IoT): A vision, architectural elements, and future directions." Future generation computer systems 29, no. 7 (2013): 1645-1660.

10. Perera, Charith, ArkadyZaslavsky, Peter Christen, and DimitriosGeorgakopoulos. "Sensing as a service model for smart cities supported by the internet of things." Transactions on Emerging Telecommunications Technologies 25, no. 1 (2014): 81-93.
11. Posted, Stefan, Stuart E. Middleton, Fernando Chaves, Ran Tao, OcalNecmioglu, and Ulrich Bügel. "A semantic IoT early warning system for natural environment crisis management." IEEE Transactions on Emerging Topics in Computing 3, no. 2 (2015): 246-257.
12. Sakhardande, Prabodh, SumeetHanagal, and Savita Kulkarni. "Design of disaster management system using IoT based interconnected network with smart city monitoring." In the Internetof Things and Applications (IOTA), International Conference on, pp. 185-190. IEEE, 2016.
13. Mitra, Prachatos, Ronit Ray, Retabrata Chatterjee, RajarshiBasu, ParamarthaSaha, SarnenduRaha, Rishav Barman, SauravPatra, SuparnaSaha Biswas, and SouravSaha. "Flood forecasting using Internet of things and artificial neural networks." In 2016 IEEE 7th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), pp. 1-5. IEEE, 2016.
14. Bande, Swapnil, and Virendra V. Shete. "Smart flood disaster prediction system using IoT& neural networks." In Smart Technologies For Smart Nation (SmartTechCon), 2017 International Conference On, pp. 189-194. IEEE, 2017.
15. Kamruzzaman, Md, Nurul I. Sarkar, Jairo Gutierrez, and Sayan Kumar Ray. "A study of IoT-based post-disaster management." In Information Networking (ICOIN), 2017 International Conference on, pp. 406-410. IEEE, 2017.
16. Suciu, George, Andrei Scheianu, and Marius Vochin. "Disaster early warning using time-critical IoT on elastic cloud workbench." In Black Sea Conference on Communications and Networking (BlackSeaCom), 2017 IEEE International, pp. 1-5. IEEE, 2017.
17. Xu, Xiaolong, Lei Zhang, Stelios Sotiriadis, EleanaAsimakopoulou, Maozhen Li, and Nik Bessis. "CLOTHO: A Large-Scale Internet of Things-Based Crowd Evacuation Planning System for Disaster Management." IEEE Internet of Things Journal 5, no. 5 (2018): 3559-3568
18. https://data.gov.in/resources/year-wise-damages-suffered-due-floods-2015-2019-ministry-water-resources (accessed on 11/12/2019).
19. https://frontline.thehindu.com/dispatches/article29530296.ece(Accessed on 11/12/19
20. https://reliefweb.int/sites/reliefweb.int/files/resources/Rev-0.pdf (Accessed on 11/12/19)

AUTHORS PROFILE

Mr. Himanshu Rai Goyal is currently working as Assistant Professor of Department of Computer Science and Engineering at Graphic Era Deemed to be University, Dehardun, Uttarakhand, India. His research interests include wireless sensor networks and IoT.

Prof. (Dr.) K. K. Ghanshala is currently the chairman and Professor of Department of Computer Science and Engineering at Graphic Era Deemed to be University, Dehardun, Uttarakhand, India. He founded Graphic Era in the year 1993 as one of his bold ventures towards providing quality educational inclusion to the society at large and people living in difficult geographies in particular. His research interests include wireless communication networks, IoT, Vehicular ad hoc networking and network security.

Dr. Sachin Sharma, is currently an Associate Dean, International Affairs and Associate Professor, Department of Computer Science and Engineering at Graphic Era Deemed to be University, Dehradun, UK, India. He is also Co-founder and Chief Technology officer (CTO) of IntelliNexus LLC, Arkansas, USA based company. He also worked as a Senior Systems Engineer at Belkin International, Inc., Irvine, California, USA for two years. He received his Philosophy of Doctorate (Ph.D.) degree in Engineering Science and Systems specialization in Systems Engineering from University of Arkansas at Little Rock, USA with 4.0 out 4.0 GPA and M.S. degree in Systems engineering from University of Arkansas at Little Rock with 4.0 out 4.0 GPA and He received his B.Tech. degree from SRM University, Chennai including two years at University of Arkansas at Little Rock, USA as an International Exchange Student. His research interests include wireless communication networks, IoT, Vehicular ad hoc networking and network security.