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HYDRO-SPARK: FLOOD LEVEL AND FLOOD WATER ELECTRIC DISCHARGE WARNING SYSTEM

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Abstract: In this paper, an attempt has been made to develop a device which is used to detect electric current leakage in flood water due to downed power lines and also to measure the level of flood water in water logged areas. The electricity board, disaster rescue team and the general public are notified about the prevailing conditions through a mobile application.

Keywords: Internet of Things(IoT); high voltage detector; microcontroller; ultrasonic sensor;

1. INTRODUCTION

The death toll caused by the floods during December 2015 had peaked to 269 in Tamil Nadu. Electrocution in flood water accounted for a number of lives. Every form of life is priceless; hence necessary steps must be taken to save them by detecting hazardous road conditions, especially during the rainy season. The Hydro-spark intends to measure flood water level and detect energized water caused due to downed overhead power lines. Further, a mobile application is built to notify people about the hazardous conditions. Flood warning systems already exist in countries like Mexico, USA, Canada, etc. But, the electric discharge detection feature ceases to exist in the previous models proposed, thereby contributing to the uniqueness of the device. Thus, Hydro-spark would prove to be an ideal system, ultimately ensuring public safety.

IoT is one of the most desirable technologies that is finding its way into various fields such as smart cities, manufacturing, healthcare, etc. It would play a pivotal role in redefining product design and services in the future. Employing the concepts of IoT, wireless sensors and high voltage detectors are used to implement the Hydro-spark. The sequence of steps involved are (1) Hydro-spark measures water level and detects energized water. (2) It activates an alarm, sends alert messages to the nearby power station and transmits the measured data over to the server. (3) From the server the data is sent to the customized application for the dissemination of information to the public.

2. LITERATURE SURVEY

Electrocution is one of the lethal causes of death during the rainy season and also during floods. The over head power lines get disconnected or cut off and fall into the water. Most of the deaths occur instantaneously when people accidentally come in contact with the energized water. This will also cause fatal injuries [1]. Also, these type of incidents are common in densely populated areas. The fatality rates are fairly high in developing countries [2]. Detection of electric discharge due to disconnected power lines can be done using high voltage detectors. And preferably, non-contact devices are safer [3]. Flood level detection can be carried out using ultrasonic sensors.

The integral part of the proposed system involves transmission of the acquired sensor data and further processing it [4]. To achieve this, the component used in this proposed system is the ESP-8266, a microcontroller which is a low cost, high performance System on Chip Wi-Fi to serial module, part of a Shanghai-based Chinese manufacturer, Espressif System's 'Smart Connectivity Platform' that aims to provide the collected sensor data to users. The microcontroller makes simple TCP/IP connections using Hayes-style commands.

The command set consists of a series of short text strings which can be combined to produce commands for operations such as dialing, hanging up, and changing the parameters of the connection. In some of the existing models, the water level monitoring has been done with the help of microcontroller based systems and circuits [5]. GSM is widely used for message transmission purposes [6]. The idea of water level monitoring can be extended to flood level monitoring system. Flood level is monitored with the help of ultrasonic sensors, building up a flood warning system to effectively notify people irrespective of their location via the mobile application [7].

The technique in which the sensor data is transmitted plays a major role. A large number of protocols are available to accomplish this task. With the help of Wireless-Fidelity module, sensors, and MQTT protocols, real time environmental data over remote locations can be monitored and updates can be received from any part of the world with an internet connection, in the absence of which local updates via TCP/IP connection is possible [8].

3. FLOOD LEVEL MONITORING SYSTEM

High voltage detector detects the presence of AC current in water. A non-contact device. The AC current detection

range is between 40-70 Hz. The device indicates the presence using a beep and by flashing of LED. Handheld and Compact characteristic adds to the advantages of the high voltage detector. LED blink sensor detects the change in LED light intensity produced by the high voltage detector. Ultrasonic Sensor HC SR04 to measure the flood water level on road. The sensors used are non-contact which can measure water level in the range of 2 cm to 400 cm depth**.**

ESP8266 microcontroller device which has a Wireless-fidelity (Wi-Fi) module. A 32-bit processor constitutes its architecture (Figure.1). It is interfaced with the sensors to collect and transmit the sensor data.

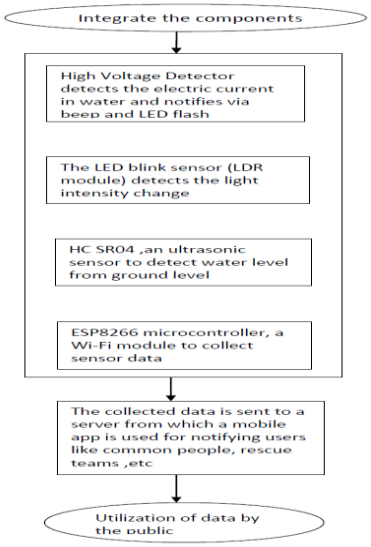

Figure.1. Proposed flood level monitoring system

4. WORKING MODEL OF HYDRO-PARK

The components include a high voltage detector, a ESP8266 microcontroller, an ultrasonic sensor (HCSR04) to measure water level, a LED blink sensor or a sound sensor and wires to connect the components. These components are integrated into a single device (inside a box), which is mounted on an electric pole or lamp post at a height of about 2.5 meters. The power lines might get disconnected due to abnormal weather conditions such as heavy rains, winds or storm and fall off in the water logged roads. The downed live wires may cause harm to people. The high voltage detector present in the device senses electric discharge. It then indicates the detection by flashing the led attached to it or by emitting a sound. To sense this, sensors are used.

The LED blink sensor or the sound detection sensor is used to detect the flashing LEDs in the high voltage detector or sense the beep sound emitted by the detector respectively. Similarly, in order to detect the water level in the water logged roads during floods, the HCSR04 ultrasonic sensor is used. This measures the level of water on the roads. The sensor records the height of the water from the ground level. A threshold value is programmed to compare the measured level of water by the sensor. In order to accomplish this task, the sensors are interfaced to the ESP8266 microcontroller. The sensors (Figure.2) in coordination with the microcontroller capture the detection.

This is then sent to a server with the help of Wi-Fi module integrated within the microcontroller. The data is then transmitted along with the location which may also be done using a GPS module. The data received at the server is then processed. During the processing of the collected sensor data, the height of the water measured by the sensor is initially compared with the threshold value. This threshold value is also considered as the safety limit. If the measured value exceeds the threshold value, the data is processed and sent to the people. Similarly, on detection of electric discharge, the data is processed.

Once this is accomplished, the processed information is sent to different categories of people in the form of notification. It is done with the help of the mobile application built exclusively for this purpose. The information is first sent to the Electricity Board (EB) so that they can cut off the power to that particular area in order to avoid accidents. Then the road conditions are notified through the application to rescue teams who can be alerted to handle any emergency situations and also to the common public which will help them to avoid those roads so as to avoid any mishaps. The Hydro Spark is installed at various low-lying areas. A survey can be conducted to identify such areas.

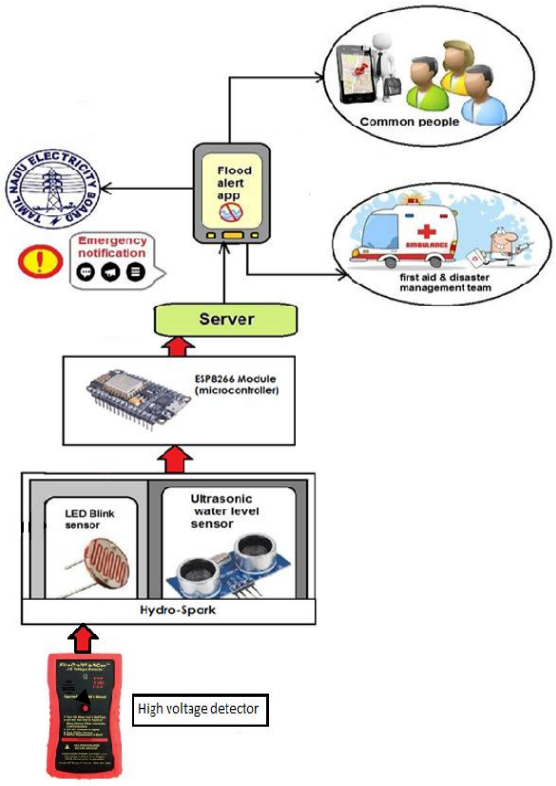

Figure.2. System implementation of hydro-spark

5. EXPERIMENTAL RESULTS

The system monitors flood water level and also detects the presence of high voltage due to disconnected power lines in water.

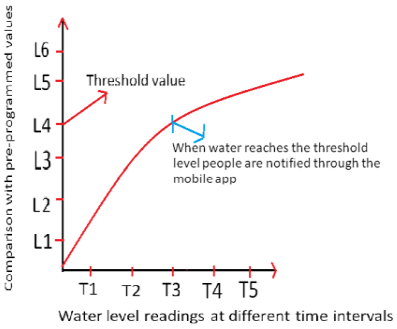

Figure.3. Water level readings

From the graph (Figure.3), it can be inferred that at regular intervals the flood water level is measured and once it reaches a threshold value or exceeds it, the data is communicated. The same principle is used to detect high voltage wherein readings at regular intervals are checked and the changes are immediately transmitted, if any high voltage is detected.

6. CONCLUSION

The main idea of "Hydro-Spark" is to avoid mishaps on the road during flood times due to downed over head power lines in flood water and also to measure flood water level on the roads. The motivation for "Hydro-Spark" was the Chennai floods in 2015. The hydro-spark is built by integrating a voltage detector, a blink sensor and an ultrasonic sensor on a micro controller. The integrated kit detects the above mentioned anomalies in flood water and communicates the data into the server. Thus the data to be analyzed is collected and then the useful information is sent to the desired receivers.

This provides a way for the receivers to keep informed about the current situations of the road, which ensures safety. This is the smart way of helping people during floods. There is no existing method to detect electric discharge in water. So, hydro spark is a need not a utility. The Hydro spark should be mounted at a certain height from the ground to detect the presence of electricity and also the voltage should not exceed the limit of 230kv. These limitations are taken into consideration while designing the device. Hydro spark is designed in such a way so as to withstand heavy floods. It is mainly designed to protect the flood prone areas of Chennai. A survey has been taken to find out the flood prone areas and low lying areas which have a high probability of floods in Chennai. The conditions and dimensions of the area are studied and the hydro spark can be mounted with appropriate threshold, respective to the chosen places.

Thus by implementing this idea we can ensure safety of the people and avoid death due to electrocution during floods. Hence Hydro-Spark would prove to be an ideal system to detect flood level as well as electric current in flood water.

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