SMART ELEPHANT ELECTRIC FENCE WITH MOTION SENSOR AND ALARM SYSTEM

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1. INTRODUCTION

Human-elephant conflict is a complex interrelationship between humans and elephants that portrays the species' adverse effects on each other. It is estimated that Sri Lanka has around 6,000 elephants within 65,610 square kilometres of land extent, creating a natural arena for intense human-elephant conflict that annually kills about 400 elephants and 70 people (Perera, 2013). Elephant habitat is increasingly being depleted as the human population expands and farming fields multiply at the detriment of forests. Since humans and elephants have similar ecological requirements, the conflict between the two species is unavoidable when they coexist in the same region. Elephants destroy crops, damaged houses, and at times even kill people. In response, enraged farmers use homemade weapons to fire, wound, or kill elephants. Therefore, several measures have been taken to rectify these human and elephant conflicts. The electric fences are installed in the areas of human and elephant conflict prone areas. Even though, several incidents have been registered in Sri Lanka where wild elephants have found a way to breach and surpass electric fences. As an alternative for the vintage electric fences, smart electric fences can be installed with a prior alarm system with motion detectors when wild elephants breach the smart fences. This system is capable of sensing the breaching of wild elephants and raises the alarm to notify the villagers about wild elephant intrusion beforehand the disaster happens. This system runs with modifications to the vintage elephant electric fences with precautionary measures.

2. METHOD

Figure 01 shows the architecture for the proposed prototype of the smart fence. The system consists of major components including a microcontroller, power source, motion detector, local storage unit connected with the Internet of things (IoT), and alarming system. The system will be operated using multiple power sources including main power, battery power, and solar power to ensure 24×7 power supply. In this proposed method, microcontroller act as a central unit to control the whole system. Local storage facilitates the storage of information regarding the smart fence system. And also, local storage will be connected with IoT devices. Infra-red assisted motion detectors are used to sense the movement when the electric fence is breached by the elephants. The alarm system will be activated when the signal is received from the motion detector as the electric fence is breached.

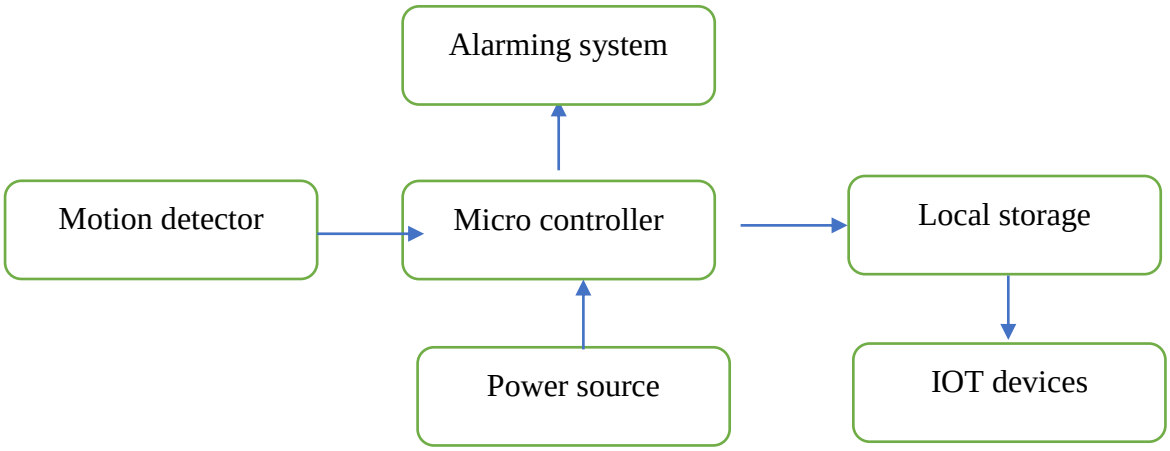

Figure 1: Architecture for the Smart elephant fence

Figure 2 explains the setup for the proposed prototype for the smart electric fence. The system will activate when the electric fence becomes a short circuit. The short circuit signal from the electric fence will be received by the microcontroller and it will activate the motion detector for sensing the movements of the elephant. Thereby, the motion detector will be activated only in the case of a breach of the electric fence. It will prevent the motion detector to sense nonrelevant movements by the small animals and the alarm system to go on.

The signal from the motion detector will be processed by the microcontroller and the relevant signal will be sent to the alarm system. When the signal is received from the microcontroller, the alarm system will go on and alert the surrounding residents about the elephant breach of the electric fence. The local storage is connected with IoT devices and it will transfer the information to the relevant bodies about the elephant breach to take necessary actions to prevent elephant and human conflicts.

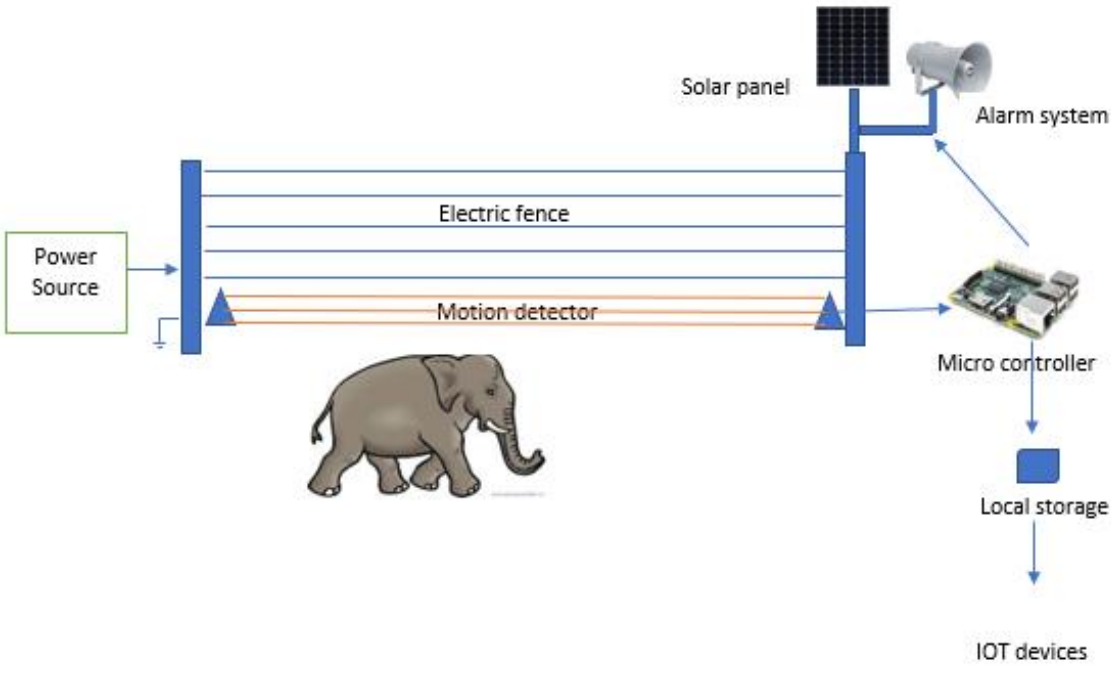

Figure 2. Sketch for the prototype

3. DISCUSSION

The proposed prototype is a modified electric fence system alternative for the existing classical electric fence built around the island where human-elephant conflicts are prone. In the case of the classical electric fence, intrusion and breaching of electric fences are often reported and ended up with collateral damage for both sides. To overcome this problem, there have been several different proposals and prototypes developed by several researchers. Fernando *et al*. (2020), proposed a smart elephant monitoring and tracking system called Gaja-Mithuru. This method is proposed to detect elephants, monitor their behaviour, and identify elephants' future attacks through seismic data related to elephants and GPS data and notify villages in advance. Theerthagiri and Thangavelu, (2020) has developed an elephant intrusion warning system using IoT and 6LoWPAN.

In our proposed prototype, elephant breaching of electric fence and intrusion could be detected earlier and alert will give in the sense of alarm. Thereby, residents around those areas can be vigilant about elephant intrusions. Further, the information regarding the breaching of electric fences will be sent to the relevant bodies to take necessary action to prevent human-elephant conflicts. The system is connected with IoT devices which facilitate the transferring the information to relevant bodies automatically. In the classical electric fences, when breaching occurred the information shas to be passed to the relevant bodies only when neighbourhood residents identified or experience the disasters. Therefore, this proposed smart elephant electric fence with a motion sensor and alarm system could be low-cost and effective method to overcome human-elephant conflicts.

4. CONCLUSION

Human-elephant conflict is a serious socio-economic issue in Sri Lanka, inflicting deadly injuries to both humans and elephants. The goal of this initiative is to protect people's lives and property while also preserving elephants. The smart elephant electric fence incorporated with a prior alarming system and connected with IoT could be an effective solution to overcome this long-existing conflict between elephants and humans.

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