Smart Infrastructure and Early Detection of Diseases in Cattle Farming using IoT

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Abstract-The main aim of this system is to make farm of a cattle smarter like infrastructure, biological activities. Every cattle is tagged with a wearable device. The wearable device is for early detection of illness, abnormalities detection and emergency handling. The sink node is responsible for smart watering and fire detection along with sprinkler actuation to make infrastructure of cattle farming smarter and safer. All sensor readings will be forwarded to raspberry pi. Through raspberry pi the readings will reach the monitors. All data along with time and date can be extracted as an excel sheet for further analysis. As a result overall cattle health and production of milk will be improved by reducing cattle health inspection costs ensures small size, low cost, high consistency and reliability.

I. INTRODUCTION

In India nearly 66.67% of rural people rely completely on livelihoods like cows, buffaloes, sheep, goat, donkey, horses, and camels. The livelihood population in India is 2.4% camels, 12.5% cattle, 56.7% buffaloes, 20.4% small ruminants, 1.5% pigs, 3.1% poultry and 1.4% equine compared to world total livelihood population [1]. Economic survey for year 2015 to 2016 reported India ranked first for milk production. Milk production of India is 18.5% of world milk production [2].The major problems in cattle farming are unable to detect illness at early state. If the initial illness (fever) not treated properly then it will develop as a disease like pneumonia, lung congestion, laminitis etc. When the severity of disease reaches high then it will easily spread to all other cattle which leads to entire cattle death and capital loss. Cattle farm infrastructure during various seasons and environmental conditions plays a vital role in cattle health.

With the advent of technology, the world around us is getting automated. Automatic systems are being favored over manual systems, as they are energy efficient and minimize the need for tedious manual labor. With agriculture being the primary economic sector of India and other developing countries, it is essential to automate it in order to increase efficiency. A typical farm requires a lot of labor. Automation can proficiently moderate the amount of manual labor, and make farming easier and faster, leading to more agricultural growth. In our project, we implement automatic lighting system, auto-sprinkler system, in¬house temperature control and security for farm houses. As temperature and motion sensitive devices will only work when required, such a system conserves energy effectively. The product also presents features to enhance the security of the farm. Case studies for cattle death due to fire accident are as follows. 30 cattle and 500 milking goats died in fire at Delaware, London. The estimated damage at goat farm which is situated near Delaware is 2 million dollars [8]. 20 calves and 50 cows died in fire at Brockton, Ontario. 500000 dollars is the estimated damage of this incident [9]. 6 cattle died because of fire accident at Shillong [10].

II. EXISTING METHOD

Out of many various reasons for traffic congestion, vehicles waiting for a longer time at a signal lights also contribute significantly for the same. Emergency vehicles blocked by such huge traffic can put one's life in danger. There is currently no mechanism available for the clearance of traffic in case of an emergency. The existing systems of manual control of traffic or predefined time for change of traffic lights are inefficient. The goal of traffic congestion control and management system is to clear the accumulating traffic as soon as possible and also to pave way for the emergency vehicles. It is a known fact that even when there are less vehicles on one lane and more on another, the green signal is turned on for the same time thus wasting precious time on green signal for empty roads. This paper proposes a solution to solve this and also aims at providing priority to emergency vehicles stuck in the traffic.

III. PROPOSED METHOD

Both wearable device and end node are designed based on device to cloud architecture and it is shown in figure1. The flow diagram for early detection of illness by wearable device.

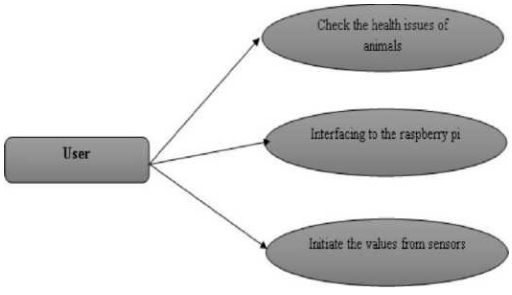

Fig 1: Use case diagram

A. Health Monitoring Sensors:

The wearable device is a small wireless sensor node with IP enabled using ESP01 8266 Wi-Fi module. The basic components of wearable device are sensing unit, processing unit, communication unit and power unit.

1) Sensing unit: The sensing unit is for measuring parameters like temperature, light intensity etc. Wearable device contains sensors namely LM35 sensor, accelerometer sensor and micro phone sensor.

a) LM35 sensor: This sensor will be kept near cattle's head to find out the temperature of cattle to detect illness.

b) Pulse rate sensor: This sensor is used to count the heart rate of the cattle for every minute.

2) Processing unit: This unit is responsible for processing the sensor readings to detect illnesses. Arduino Nano is used as a processing unit in this wearable because of its small size and low power consumption. Its operating voltage is 5V DC and 16MHz is its operating frequency. It has dedicated serial peripheral interface, 8 analog to digital converter and 14 GPIO out of that 6 pins can be used as pulse width modulation.

3) Communication unit: This unit is used for sending data from one sensor node to another or to cloud. The communication unit of wearable device is ESP01-8266 Wi-Fi module. Its operating voltage is 3.3 V DC.

4) Power unit: This unit is power supply provider to all the components. 5V rechargeable battery is used in this wearable device as a power unit.

B. Smart Infrastructure Sensors:

The processing unit, communication unit and power unit of sink node is as same as wearable device. Only the sensing unit for various module changes. The various modules in sink node are smart watering module and smoke detection and intimation module.

1) MQ-02 smoke sensor: This sensor is used for detection of smoke level in cattle farm.

2) Water level Sensor: This sensor is used to provide the water for the cattle in a smarter way.

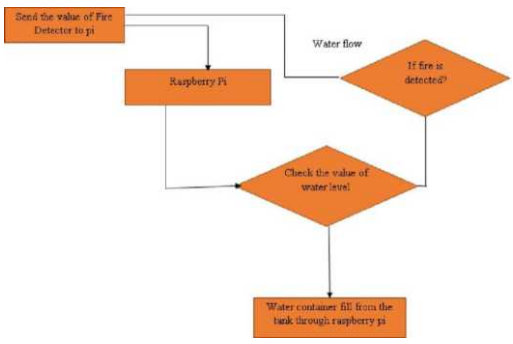

Fig 2: Flow chart diagram

C. System Architecture

Framework engineering is the calculated outline that characterizes the structure and conduct oflalframework. It characterizes the framework segments orlbuilding pieces and gives an arrangementlfrom whichlitems canlbe obtainedland frameworkslbuilt up, thatlwill cooperate to execute the general framework.

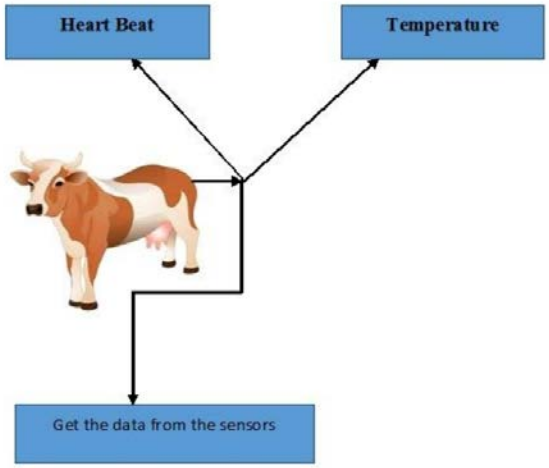

Fig 3: System designing architecture!

The health monitoring sensors are tagged to the cattle where the sensors will sense the current pulse rate and the temperature of the cattle if any variations found in the pulse rate or temperature then that sensed data will be sent to the respected fanner.

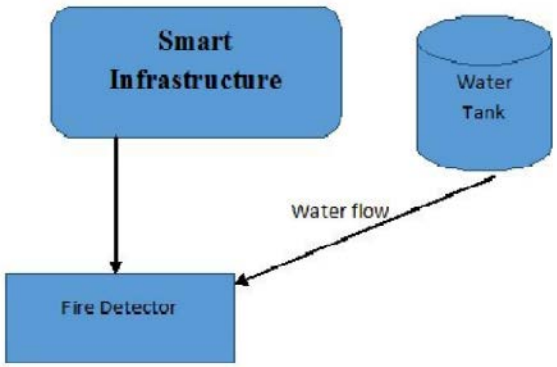

Fig 4: System designing Architecture2

The above figure depicts the smart watering and the smoke identification where the tank will be automatically stored if the water gets empty. If any smoke or fire is seen then the fire extinguisher will automatically extinguished and the message of that accident will be sent to that respected farmer.

IV. EXPERIMENTAL RESULTS

Fig 5 : Output result

The figure shows the output screen of the information of the cattle health, when the cattle is in abnormal condition. The figure shows the output screen of the smart watering when the water level is low it shows low and after the water level is reached it shows high. The figure shows the message display screen of the farmer when the cattle is in critical condition and also the identification of a fire in the cattle farm.

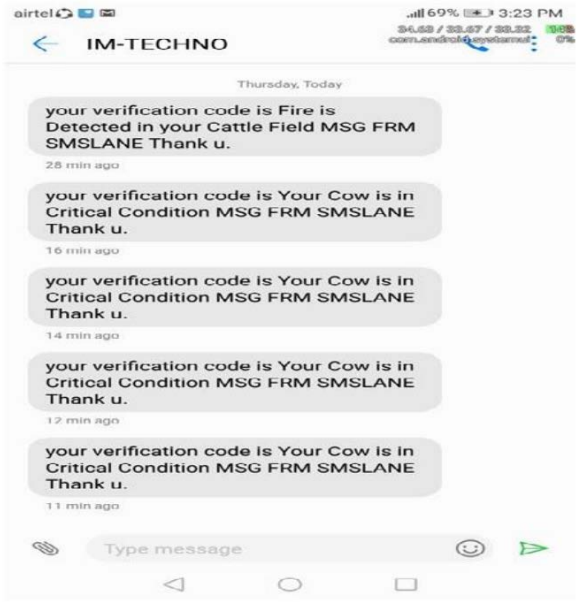

Fig.6 Alert Message.

V. CONCLUSION AND FUTURE SCOPE

The main focus of this proposed system is on making the infrastructure of cattle farm smarter and to detect, notify and handle illnesses at earlier stage, abnormalities, emergency conditions, calving time and diseases using Internet of Things.GPS assisted wearable improves location tracking of all cattle. Because of the deployment of various sensors in wearable like temperature sensor, microphone sensor and accelerometer sensor improves consistency, resolution and reliability of output. Arduino Nano and ESP-01 8266 Wi-Fi module in wearable and sink node greatly reduces size as well as cost of product without affecting performance. Smart ventilation system improves cattle health by preventing environment to reach critical. Smoke detection and intimation system improves safety to cattle and cattle farm from fire accident. Smart watering ensures water availability to all cattle at any time. Smart ventilation and smart lighting saves consumption of electricity which leads to save lot of money. As a result this system saves time and maintenance costs for the farmer ensuring improved cattle health and high yield.

The project has very vast scope in future like we can implement a invasive wearable to track the cattle using GPS assisted wearable improves location tracking for all cattle .We can also smart ventilation and smart lightening to upgrade the cattle farm.

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