Monitoring of Honey Bee Hiving System Using Sensor Networks

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Abstract:- Honey bees have throughout history been a keystone species, pollinating an estimated 70 percent of all plants and underpinning some 30 percent of the global food supply. Because the viability of beehives is a critical predictor of the planet's future health and agricultural sustainability, reports of a precipitous decline in the number of colonies around the world have stirred considerable alarm. Since most of the prior contributions are focusing on data gathering, the approach to focus on the user's needs is central to take next steps in the field of using sensors for Beekeeping. Beekeepers can be divided into beekeepers having bees as a hobbies and beekeepers that are professional, making a living of the beekeeping. Visualization and availability of data are key questions for user friendliness. Since there are no standards for measurement data from beehives, there are different manufacturers/contributors that have their own system. If a standard format would be available, it would make it easier to interconnect different devices for visualization in single user interface. If data is available as streams in standardized application program interface (API) a user can use whatever solution found for visualization. The majorities of beekeepers that non-professional, they will probably want to have the "relation to their bees", using too much technology is probably wanted, like having robots doing the actual beekeeping work.

Keywords:- Application Program Interface (API).

I. INTRODUCTION

Honey bees are important for pollination of crops. Honeybees produce different functionalities in our ecosystem, where the two main outcomes are the pollination of crops and honey. There are other products from the bees including Royal Jelly, Pollen and Propolis that are produced by bees. Bees are important for the global food supply, as the quantity and quality of food are increased by pollination, and honeybees are a major pollinator. Crops, including fruits like strawberries are dependent on pollination from bees. The products that are produced by bees need to be harvested and handled from the beehives, normally done by a beekeeper. The beekeeper either keeps bees as a hobby or as a profession where the outcome is important.

Since many years humans have tried to harvest honey from the bees, a proof of activities are old cave paintings approximately 8000-9000 years old. The other technical improvement is the queen excluder, which makes a "barrier" between the area where the queen lay eggs, and the other side of the barrier where only worker bees smaller can pass. The queen excluder makes boxes with only honey, and no eggs, easier to handle for the beekeeper. These two improvements made beekeeping easier and more efficient to product. The bees are normally kept in hives, consisting of "houses". Inside the hive there are frames with cells of wax. The wax is a product of the bees. In a cell the bees can store pollen, honey or have a new bee produced. The bees are produced by the queen, which lay eggs in cells, and then the worker bees are feeding the egg to become a bee in 21 days.

The high proportion of non-professional beekeepers and the number of colonies per beekeeper were the only common characteristics at European level. This fact need to be taken into consideration, that the main group when it comes to beekeepers are not mandatory to make a living from their beekeeping. Today beehives are placed not only on the traditional countryside, but also in the cities. The reason could probably be that people are becoming more aware of the positive side of honeybees. A main part of beekeeping is the manual inspection of beehives, a "craftsmanship" where the person doing the activities must understand the nature, what to observe and what to actions to take. Reading books, papers can helpful, especially for understanding, but when it comes to observation, judgments, comparison, and actions, experience will help the beekeeper to do a better job. The manual inspection of a beehive is assumed to be done by a beekeeper or a group of beekeepers wearing protective clothes. The aim of a visit to the beehive, are observation, probably some decision-making from observations, and some actions. Depending on the time of year, there are different activities in the beehive, also the local weather conditions affect the activities. Beekeepers are normally doing manual inspections of their hives, to check weight, health etc. To observe the bee health, the reproduction is always interesting. So, checking for eggs, pupae and cells of bees are central when it comes to observation. The number of eggs/larvae/pupae need to be put in context of the time of year, the natures current situation and the specific beehives specific situation. If there are eggs, a queen is present, if the pupae are "normal" it's a mated queen laying eggs. If you don't have fresh eggs during active season, there are probably a problem, then you need to locate a queen visually, and probably take

some action to provide a new queen. Another thing to observe is, if there are pollen and nectar present in the nature, one could expect a lively colony, with many bees, much honey, some of it already. The weight of the hive is interesting during the whole year, are there enough food during low season, and how much honey can I expect? During winter time, a beekeeper can feel the heat under the top of the roof separated by plastic to avoid stinging, which indicates a healthy society.

➢ *Objectives*
- To know the weight of the honey and free from human intervention.
- To know the temperature inside the honey comb.
- To know the humidity inside the honey comb.
- To check whether the Queen bee is present or

II. LITERATURE REVIEW

Anand *et al* [1] Honey bee holding is a deep rooted practice of holding colony states for acquiring nectar and other apiary based absolutely items and is in fact named as apiculture. This paper proposed a gadget that identifies swarming the utilization of two remarkable methodologies. The first being, utilizing sound-related assessment of the sound created by utilizing the honey bees all through swarming. What's more, the subsequent methodology, recognition by methods for following microclimatic changes and varieties inside the weight. Once swarming is detected the gadget is designed to alert the apiculturist by cloud services. The measurements together with brood temperature, brood humidity, surrounding temperature and weight of the hive can likewise be gotten to from the cloud server with the guide of the honey bee attendants, subsequently making the colony following procedure free from human intercession.

Daniel M. Lofaro *et al* [2] suggested that honey bees are a significant piece of our reverberation framework. Pollinators, comprising of honey bees, help in any event 30% of the world's yields and 90% of the world's wild intends to flourish through cross-fertilization. Studies show that among 2015 and 2016 beekeepers lost 44% of honey bee settlements over the winter that is up around 10% from the previous decade. Foundations for this decrease is associated to the general hive wellbeing. The more sound the hive the more noteworthy likely it's far to keep on existing the winter. Current time directs people check the hives for Varro Mite pervasions, awful dampness levels, and diverse telling side effects of an undesirable hive. These checks are obtrusive to the honey bee provinces and just happen a few times each year. Foundations for this decrease is associated to the general hive wellbeing. The more sound the hive the more noteworthy likely it's far to keep on existing the winter.

Zacepins *et al* [3] recommended that honey bee wintering process is one of the natural procedures, which these days might be checked and controlled the utilization of the data innovation, control strategies and devices. Control and following of such method is truly entangled

and no longer an insignificant errand, since direct of the natural gadget, natural items and their reaction to human mediation is erratic. To entire this undertaking it's far imperative to assemble complex control machine engineering with numerous subsystems and components. The automatized framework engineering proposed through the creators is created to upgrade the honey bee wintering process and to consolidate realities advancements into this technique. The machine is uncommonly utilized for singular bee state checking and control.

Edwards Murphy *et al* [4] Checking the sounds discharged with the assistance of honey bees for the term of an apiary is a basic side interest for beekeepers to frame positive that their honey bee provinces stay solid and to augment productiveness. A one of a kind conceptive event called "swarming", incorporates the flight of a sovereign with an outsized a piece of the hive masses. Swarming are frequently recognized through sound, and whenever permitted to happen unchecked may result during a drop by means of hive efficiency or, in extreme cases, settlement demise. A method for effectively alarming the manager that such an occasion is inevitable would asset in protective the bumble bee populace and diminishing beekeeping costs. During this paper, an answer the utilization of off the rack Wireless Sensor Network (WSN) time with low power sign handling to show settlement sound, likewise because of the reality the temperature and mugginess of the hive inside is introduced. The contraption manages markers to the beekeeper while an event is distinguished. The hub become intended to parent with a bigger sensor network intended for observing wellness and states of the bee sanctuary, and utilizes the system from this framework to transport cautions. An interfere with circuit gave a stir sign to the hub even as the sound identified with a significant occasion got recognized. This made the appropriate response ultra-low force, by method for turning on the account circuits handiest even as that they had been unequivocally required. During this paper the creation plans and improvement of the model gadget is depicted, with the after effects of primer tests and assessment. A vitality examination and force accounts affirmed that a definitive arrangement have become power unbiased, giving extra vitality to energizing, even inside the instance of various chronicle cautions over the span of an unmarried day.

Rodriguez *et al* [5] proposed an acknowledgment framework for dust bearing honey bees from motion pictures of the passageway of the hive is introduced. This pc vision undertaking can be a key part for the mechanized observing of honey bees with an end goal to get large scope data of their scavenging behavior and task specialization. A few methods are contemplated for this task, alongside gauge classifiers, shallow Convolution Neural Networks, and more profound systems from the writing. The trial differentiate depends on a substitute dataset of depictions of bumble bees that was physically explained for the nearness of dust. The proposed technique, upheld Convolution Neural Networks is appeared to beat the contrary procedures in expressions of exactness. Detailed examination of the outcomes and accordingly the influence

of the building parameters, similar with the impact of devoted shading based data increase, offer bits of knowledge into the best approach to apply the method to the objective application.

Although more profound designs may have the capacity for advanced by and large execution, they did never again really perform higher than shallower structures on this dataset and included longer calculations. In reality, with the guide of in regards to a major number of parameters, they generally require a decent arrangement enormous datasets. Right now, factor out that the size of the dataset utilized speaks to an upper confine to the speculation that would be asked from a stop purchaser as far as totally directed a documentation to refine the designs for a specific machine at the field. So as to assess an approach to improve the general execution and appropriateness in the field, it's miles subsequently an energizing question for future work, how bigger scope datasets with great top of the line explanation can be made with the guide of utilizing the classifiers proposed right now automatized assortment and approval of honey bee pictures.

Zacepins *et al* [6] suggested that execution of accuracy apiculture techniques into training is exceptionally confided in accessibility and cost-adequacy of honey bee following gear. Costs of following framework establishment and protection sports furthermore ought to be limited. So as to successfully anticipate unprecedented honey bee settlement states like: swarming, choose nectar assortment action and strength of honey bees each in fiery and detached wintering period, insignificant hive parameters that must be checked are temperature and mass. This exploration gives applied plan of Internet of Thing system for the beekeeping. Additionally honey bee province temperature observing framework bolstered neighborhood Wi-Fi, sensor network along perspective Global System for Mobile discussion (GSM) outside interface for parcel put together correspondence with faraway server with respect to the net is created. Topology of the close by network is superstar with one urgent module. The hive bunch comprises of 10 units. Each hive inside the gathering is given essential temperature sensor chip (±0.4℃ precision), low quality microcontroller and recurrence (RF) handset module. All added substances are controlled through antacid cell battery, which may likewise give power to one year least of self-supporting activity with 10-minute records logging interim. The important module is furthermore situated on one some of the hives and incorporates temperature sensor, RF (Radio Frequency) and GSM/GPRS (Global System for Mobile Communication/General Package Radio Service) modules, sun cell exhibit, battery, charge controller and least interface for operational notoriety detailing.

The machine permits sensor data logging to neighborhood carport and occasional sending to an abroad server for furthermore point by point examination in client net or cell application. Exactness beekeeping course of the accuracy horticulture stays in developing stage. These days there are select size frameworks to be had for continuous bumble bee province observing. As of late IoT is drifting inside the region of ICT (Information and Communications Technology) and speaks to the long haul of processing and discussion. Execution of IoT measures in Precision beekeeping could give a boundless impact on PB improvement. Honey bee GPS beacon utilizes vitality green sensor hubs that comprises of minimal effort, extremely precise (±0.4 ℃) temperature sensors with an espresso power Wi-Fi dispatch modules. Such a gadget are regularly situated out additionally all through a faraway regions, considering the most module is vivaciously self-enough and speaks with the database over cell arrange. Sensor hubs can chat with the most extreme module all through a separation of 20 m in open subject. Information are sent to the greatest module at some phase in brief interim (containing estimations of temperature and battery level of the exact sensor hub) in which the most extreme module at that point performs transmission of these measurements following 10 minutes. In this way portrayed device are much of the time mulled over as a significant part throughout a Smart apiary the board limiting the requirement for manual hive examination yet the hives are situated in rustic territories or woods.

For future conversations and more machine vitality sparing purposes it are frequently considered to transport from remote hubs handiest temperature changes esteems and basically on the off chance that temperature is ordinary don't send rehashing values.

Edwards Murphy *et al* [7] suggested that bumble bees have held a fundamental job in farming and nutrients from the dawn of human progress. The most fundamental job of the honey bee is fertilization, the expense of fertilization subordinate plants is normal at 155 billion for every a year with bumble bee's identified as the most basic pollinator creepy crawly. It is clear that honey bees are an indispensably significant a piece of the environmental factors which can't be permitted to fall under decrease. The test illustrated on this paper utilizes Wireless Sensor Network (WSN) time to show a bee sanctuary province and amass key data about action/environmental factors inside a colony just as its encompassing region. This task utilizes low force WSN advancements, alongside novel detecting strategies, quality impartial activity, and multi-radio correspondences; close by distributed computing to take a gander at the conduct inside an apiary. The bits of knowledge picked up by means of this diversion should decrease future charges and upgrade the yield of beekeeping, additionally as providing new scientific evidence for heaps of honey bee medical problems WSN is an emerging modern-day generation, key to the novel idea of the web of Things (IoT). Contained installed detecting, registering and remote discussion gadgets, they need found applications in about each factor of everyday life. Educated by methods for scholars theories, this artistic creations utilized existing, industrially accessible WSN frameworks close by exceptionally manufactured structures in a cutting edge application to watch bumble bee wellness and side interest so as to higher perceive the best approach

to remotely screen the wellness and lead of the honey bees. Heterogeneous sensors had been sent, observing the bumble bees inside the hive.

Climate conditions over the span of the organization had been recorded and a relationship among the hive circumstances and outside circumstances transformed into watched. A full answer is introduced, for example, a shrewd hive, correspondence, and records accumulation and perception devices. Future compositions will have some expertise in improving the quality execution of the framework, presenting an extra specific arrangement of sensors, actualizing a device examining calculation to extricate that implies from the realities without human supervision; and making sure about additional organizations of the framework.

Thomas D. Seeley *et al* [8] proposed a paper that declares Worker channeling, which is accounted for just in hives, was seen in swarms as they sorted out to lift-off to travel to a substitution home. Flute players are energized honey bees which scramble through the swarm bunch, delaying each second going to emanate a funnel. Each channel comprises of an authentic heartbeat which keeps going 0.82‡.43 s and ascends in fundamental from 100-2 hundred Hz to 200-250 Hz. Many, if now not all, of the flute players are home site online scouts. The scouts pipe when the time has come to invigorate the non-scouts to warm themselves to a flight-prepared temperature (35C) in instructing for lift-off. The time-course of representative funneling fits that of swarm warming; each start at a coffee level, around an hour prior to lift-off, and each form to a peak at lift-off. After they barred flute players from honey bees hanging in the cool, peripheral layer of a swarm bunch, they established that those honey bees didn't heat up. The type of laborer funneling which have concentrated in swarms varies from the state of representative channeling that others have concentrated in hives expressed as "wings-all in all funneling" (in swarms) and "wings-aside funneling" (in hives).

III. APPLICATIONS

- ➤ It will be made possible to hive under unfavorable weather conditions.
- ➤ By using the sensor network whole farm can be brought into control.
- ➤ The Listening on the sound gives good hint of what is going on, using computer power to analyze sound will make a trigger for an alarms system.

IV. ADVANTAGES

- ➤ Autonomous design reduces human errors in controlling, thus reducing labor dependency.
- ➤ Reduces the labor charges.
- ➤ Having temperature and pressure sensors helps to get the perfect yield.
- ➤ No wastage in the final product.

V. CONCLUSION

This paper which mainly deals beekeepers in general, are nature interested people and can see their bees as pets. Listening to bees on remote would probably be nice, having automatic analysis of the sound would make a detection system, as the probably will do. Using weather data in combination with weight could serve as a good detection system for bees during winter/spring for "need to feed", and during summer season, "time for expansion" or "time to harvest". However, all this data needs to be analyzed in the context of beekeeping. All beekeepers have different routines and details in their methods. Andersson means a beekeeper have no use of information, if there are no plans for actions, due to the information. Since there are majorities of beekeepers that non-professional, they will probably want to have the "relation to their bees", using too much technology is probably not wanted, like having robots doing the actual beekeeping work.

VI. ACKNOWLEDGEMENT

REFERENCES

[1]. Anand [1], the work presented in this paper was focused on developing a system that could help monitor the beehive and detect swarming by two methods.

[2]. Daniel M. Lofaro [2], proposed that bees are an important part of our echo system. Pollinators, such as bees, help at least 30% of the world's crops and 90% of the world's wild plans to thrive via cross-pollination.

[3]. Zacepins [3], proposed that Honey bee wintering process is one of the biological processes, which nowadays can be monitored and controlled using the information technologies, control methods and tools.

[4]. Edwards Murphy [4], Monitoring the sounds emitted by honey bees in a beehive is an important activity for beekeepers to ensure that their bee colonies remain healthy and to maximise productivity.

[5]. Rodriguez [5], proposed a recognition system for pollen bearing honey bees from videos of the entrance of the hive is presented.

[6]. Zacepins [6], proposed that implementation of precision apiculture methods into practice is highly depended on availability and cost-effectiveness of honey bee monitoring equipment.

[7]. Edwards Murphy [7], proposed that honey bees have held a critical role in agriculture and nutrition from the dawn of human civilization.

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