

**DOGODO: IOT BASED ENHANCED MOBILE
APPLICATION TO PROVIDE ESSENTIAL HEALTH
SERVICE TO DOGS- SMART TRASLATOR**

2021-162

Project Proposal Report

MOHMAED SALMAN SALAY-IT18006858

B.Sc. (Hons) Degree in Information Technology

Department of software engineering

Sri Lanka Institute of information technology

SRI LANKA

March 24th

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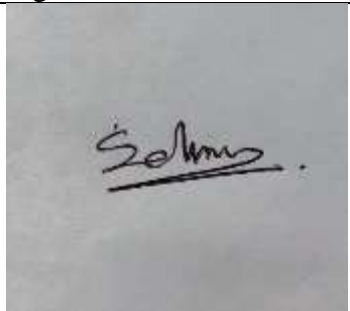
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Declaration of the candidate & Supervisor

We declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student Id	Signature
SALAY M S	IT18006858	

The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor:

Date

Abstract

In a study, we analyzed that there are so many pet lovers especially dog lovers. Most of them take care of their dogs with their experience. What if a dog lover is an armature who has no previous experience with dogs. Here a device with a mobile app has been proposed as a smart assistant which will help dog owners to take better care of their dogs and have a better understanding of their pet dog. The mobile app has four main components. Smart Health Analyzer, Smart translator, breed your pet, and per skincare are the main four components.

As my part, I will be doing the Smart translator which is a component that will help the owner to better understand the dog's mental state and what the dog is trying to communicate. Using a modern machine-learning algorithm, the possible context-specific and individual-specific roles of dog barks were studied. The function of the algorithm was to understand the acoustic characteristics of the barks, collected in various contexts and from different individuals, and then it will help to identify the barking pattern which will output what the dog is trying to communicate. The software will perform this activity by evaluating barks emitted by identified dogs in previously identified contexts.

Keywords : acoustic characteristics of the barks, machine learning, barking patterns, evaluating barks

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List of abbreviations

1. KASL - Kennel Association of Sri Lanka
2. CKC- Ceylon Kennel Club
3. IoT – internet of things
4. ML- machine learning
5. AI- Artificial intelligence
6. Rs. – Sri Lankan rupees

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1. Introduction

1.1 Background

Dog has been the most loyal animal to humans since human evolution. Dogs were domesticated by humans around 15,000 years ago by cavemen. Since then dogs have been around humans. Dogs are loyal companions to their masters and intelligent animals. They have crossbred for a long time now and therefore there so many dog variants in the present. Even though dogs are the most preferred pets around the world lack of knowledge about their pet dog leads to different physical and mental disabilities.

For their well-being and dog owners' convenience, many countries have developed innovative IoT-based software, hardware, and smartphone apps for dogs. Besides, it is difficult to procure such equipment from other countries to universal access via a smartphone app, and, worse, it does not help relevant services where appropriate. Also, in some regions, some services are limited and can cost more than caring for dogs. Dogs communicate in different ways with their owners. They communicate by wagging their tales, using different barking sounds and different expressions, and soft bites. Among these communicating ways, barking sounds are their main way of communicating with humans.

.In some of these instances, dog owners leave the dog without understanding how to respond to their behavior, breeding, and unique disease-related concerns relying on their health and behavioral issues. Due to the extreme frequent acts of people dumping dogs, the number of abandoned dogs has steadily risen.

Now in modern days, information communication technology has been applied to solve modern issues. What if to solve the pet dog communicating problem modern information technology concepts like machine learning, artificial intelligence, IoT, and Smartphones can be applied? In Sri Lanka, the KASL- Kennel Association of Sri Lanka offers a device that offers only limited functionality. It contains owner and dog information. This device only provides kind of a identification to the dog and there is no translating functionality.

A dog translator was developed back in 2003 by a Japanese company named “Takara”. The device was called “BowLingual”. This device required a separate device to do the translation. Back when it launched a cost around \$120 and now used

unit is around \$100 since it is extremely rare and expensive. The company discontinued the device back in 2006 and a new device cannot be purchased now. [1]. Another version was launched again “Meowlingual” was only issued for the Japan market. This was issued only in the Japanese language. No other versions were released. This device had many issues when identifying sounds and barking patterns[2].

The best and most effective solution that can be purchased is the “BowLingual.” This device requires to carry an additional device that has only limited range and needs considerable amount of time to capture and process acoustic characteristics of the barks due the device has only very limited processing power and the processing is done inside the special device. Other than these limitations this device has other technical limitations as well. A summary can be written as below[01]

BowLingual uses custom-built voice-print analysis technology that has been tailored for dog barks. The accuracy of this product is tormented by different conditions and things. Sound interference will occur once the wireless collar-microphone picks up noises created by chain collars and collars with dog tags connected. As a result, the dog owner might believe that the device is malfunctioning and not registering the dog bark properly. In windy conditions, the mike can generally interpret a blow of wind as a bark. Electrical instrumentation and bound radio signals might trigger false readouts. Because of enhancements with the U.S. and Canadian versions of the merchandise, these issues are a lot of common with the Japanese and South Korean versions.[02]

One reviewer of the merchandise stated that "it's not terribly helpful as a result of the translations are not trustworthy and most do not be.[02]

There are other mobile apps[3] like ‘Cat and dog translator’, ‘Dog translator simulator’ are just apps for entertainment purpose only which has not scientifically proven that they can actually translate.

To solve these problems proposed smart translator will be using a machine-learning algorithm to identify dog bark patterns to understand what the dog is saying. This will help the owner to get a better idea about the dog. The translator makes the owner and pet more intimate. Dog sound translator system where you record your pup's barks in real-time to find out what they are saying and their feelings (joy, fear, anger, love). The output will be seen in the owner's phone app and no additional device will be required.

1.2 Literature survey

To identify the level of dog owner's have a survey was conducted . The survey was created using a google docs. Randomly dog owners were chosen around Sri Lanka and the survey was distributed to them through social media such as Facebook, WhatsApp. Also, the survey was emailed to some dog owners as well. The survey had questions to cover our entire group research and here only related to smart translator which is my topic will be evaluated. Around 47 responses were collected from dog owners like Ridgeback, rottweiler, German shepherd, Labrador, beagle, lion shepherd. According to the survey following figure shows the level of knowledge about dogs of dog owners.

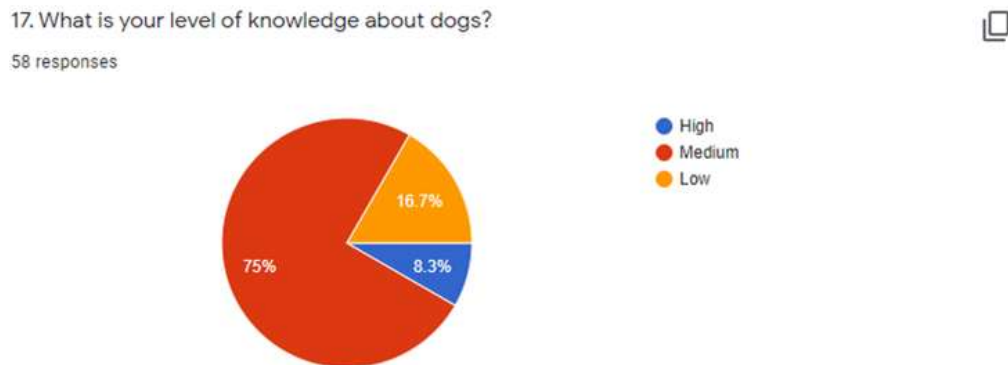


Figure 1:1:Knowledge level of dog owners

According to this graph even though dog owners have around with their pet dogs for while the level of knowledge of most dog owners is medium. According to the survey, only 8.3% of dog owners think they well know about their pet dog. The majority which is 75.0% is in the medium knowledge level and some are in 15.7% which is a low level.

1. How well do think you understand your dog?

58 responses

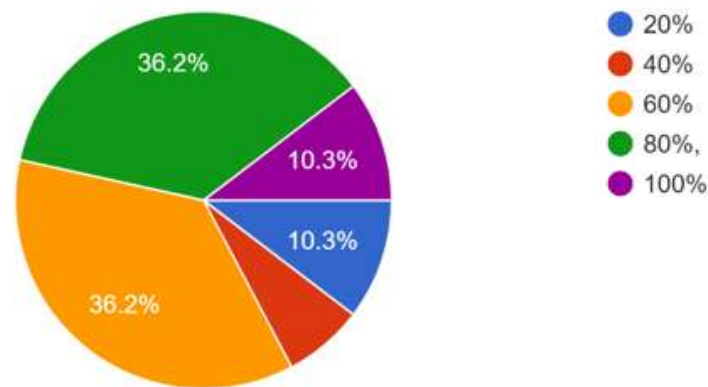


Figure 1:2: How well you understand your dog

According to the above graph dog owners has indicated their level of understanding what the dog is really communicating. Only 10.3% of dog owners think they can understand their pet dog in an excellent level while 36.2% owners think they can understand their dog up to a good level. Majority of the communication level is 60.0% or below level according to this graph that indicates most dog owners understand their dog to an average level. This communication understanding level gap to in some instances, can lead dog owners leave the dog without understanding how to respond to their behavior, breeding, and unique disease-related concerns relying on their health and behavioral issues .

3. If you understand that the dog is suffering what would you do?

58 responses

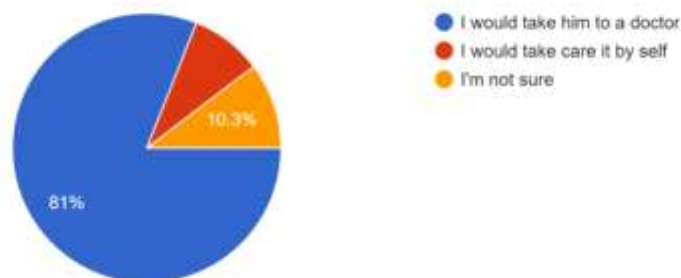


Figure 1:3:If the dog is suffering from an illness/pain

If we refer to the above graph figure we can observe that majority of the dog owners are willing to attend to their pet dog if the dog is ill or if its suffering from any kind of pain. To attend in a such manner the dog owner should understand the well should understand what the dog is trying to communicate to the owner. If the dog owner could not capture what the dog is trying to communicate the dog will end suffering or even death.

4. Would you like to have a device that would help the understand the dog better?
58 responses

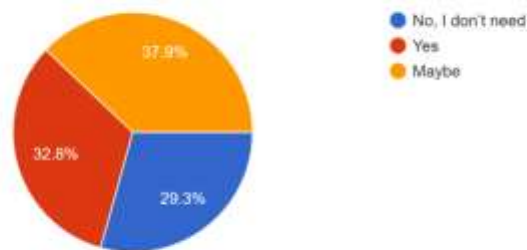


Figure 1:4:If the dog owners is willing to get support from a device

If a situation occur as such most dog owners are going to face major problem. According to the above mention graph we can observe that majority of the dog owners are willing to get assistance from a smart device to better understand their pet dog. Only roughly around 30% of the above dog owners are not willing put some extra effort to get such a device. 70% of the owners are willing to do so . If a smart assistant could identify the dog barking pattern and output what the dog is exactly trying to communicate the owner could get a better idea of their pet dog. Also, it will help the owner understand the mental state such as Happy ,Sad, Hungry ,pain and etc. With a help of a device then the owner will able to attend to the dog in a proper manner.

2. Research gap

When taking into consideration all the readings illustrated in the literature survey, it is distinguishable that there is a considerable audience in the society who interested in understanding what their pet dog is trying to communicate to them but due to the lack of knowledge and the experience required most dogs are not aware what the dog trying to communicate. Therefore they may be not able to properly attend to their pet's physical and mental wants and needs. Especially the mental state and mental requirement. Unlike physical requirements, mental needs cannot be seen physically. These can be identified by only carefully listening to the dog's acoustic characteristics of the barks. Veteran dog owners may be able to identify this based on their experience but most armature dog owners might not understand this. Due to this reason, most inexperienced dog owners are willing to get all the help they can to understand their dogs better. Therefore most dog owners don't mind spending few bucks on a device that could help the owner understand their dog better.

Even though there is a clear requirement for a dog translator from dog owners, but when a dog owner seeks such a device that can translate their dog's barks there are very limited dog translator solutions available in the market. As we tested most mobile apps are just simulators[04],[05],[06] which has no actual proper translation and other available device has many constraints to them.

Today smartphones are so common and almost everyone owns a smartphone. Smartphone has been evolving and these device has been improving to be almost good as modern computers with plenty of processing power but this processing power has not been utilized to understand your pet dog's communication properly. With the help of cloud services, this processing power can be improved further for better analyzing performance. Unlike other translating devices if the smartphone can be used

for translation, no additional device is required to carry and since modern smartphones are powerful devices these translations can be done much more efficiently spending much less time. According to a research done by “Molnár, Csaba Kaplan, Frédéric Roy, Pierre Pachet, François Pongrácz, Péter Dóka, Antal Miklósi, Ádám” on classification of dog barks: A machine learning approach only on how machine learning algorithm models will work in behavioral science of dogs barking patterns.[07]. It has been only focused on how the algorithm will be behaving and there are no any practical implementations. The study results has only focused on some of very basic dog barking behavior. With an IoT device ,Smartphones and cloud service no practical implementations has not been tried before on dog barks translating.

3. Research problem

Dogs are sensitive, intelligent, social and loyal animals to their human companions. When it comes to dog owners according to the survey results now we can understand that there are mainly two types of dog owners. They are well experienced dogs owners who has been pet dogs for a long time and inexperienced dog owners who has very little knowledge on dog's behavior and barking vocal patterns .Unlike experienced dog owners, inexperienced dog owners don't have a good idea what their dog is trying to communicate. What if the dog is in pain or the dog needs any special attention and it snarls in discomfort but the inexperienced dog owner does not understand what the dog is trying to say and just ignores the dog?. Dog will suffer for sure and if it is a critical condition the dog might even face death! If the owner could understand or some experienced dog owner could translate to the inexperienced dog owner they will attend to dog without any hesitation. Always seeking help from a experienced dog owner can be disturbing to both parties. What if a special device could do that for the owner?

There are only very few cases where machine-learning techniques have been used in behavioral research on dogs. With a machine learning approach can a dog's acoustic barking patterns analyzed and assessed to understand the dog better ? Can the dog barking pattern translate and displayed to a smartphone device real time?

Compared to human language dog language is less complicated.[08]. To translate and interpret animal vocalizations such as barks, groans or howls into a language that can be understood by humans, using artificial intelligence and machine learning approaches has not been successfully completed yet. With the ever increasing applications of machine learning and artificial intelligence can it be applied on translation and for vocalization patterns identification? If a dog's acoustic barking patterns analyzed and assessed most owners will understand exactly what the dog actually needs. Also, with a help of a pre trained machine learning model can it be identified? To answer this questions a classifier must be created . To train the model data will be need to classified on a behavioral approach. Behavioral approaches mostly will be on feasible solutions more than optimal solutions due to their nature of behavior can sometimes be unpredicted. This project involves research into investigating the most efficient, effective way of translating pet dogs vocal patterns to a smartphone to understand what the dog is communication and the mental state of the dog such as happy, sad, need to be loved, scared, needs attention .

4. Objectives

4.1 Main Objective

Our main goal is to create an efficient and effective mobile app for dogs well being that allows users to easily access a wide variety of services for their pet dogs in one place. It makes dog owners and dogs lives much more comfortable, and focus dogs' health and well-being are major concerns for many owners.

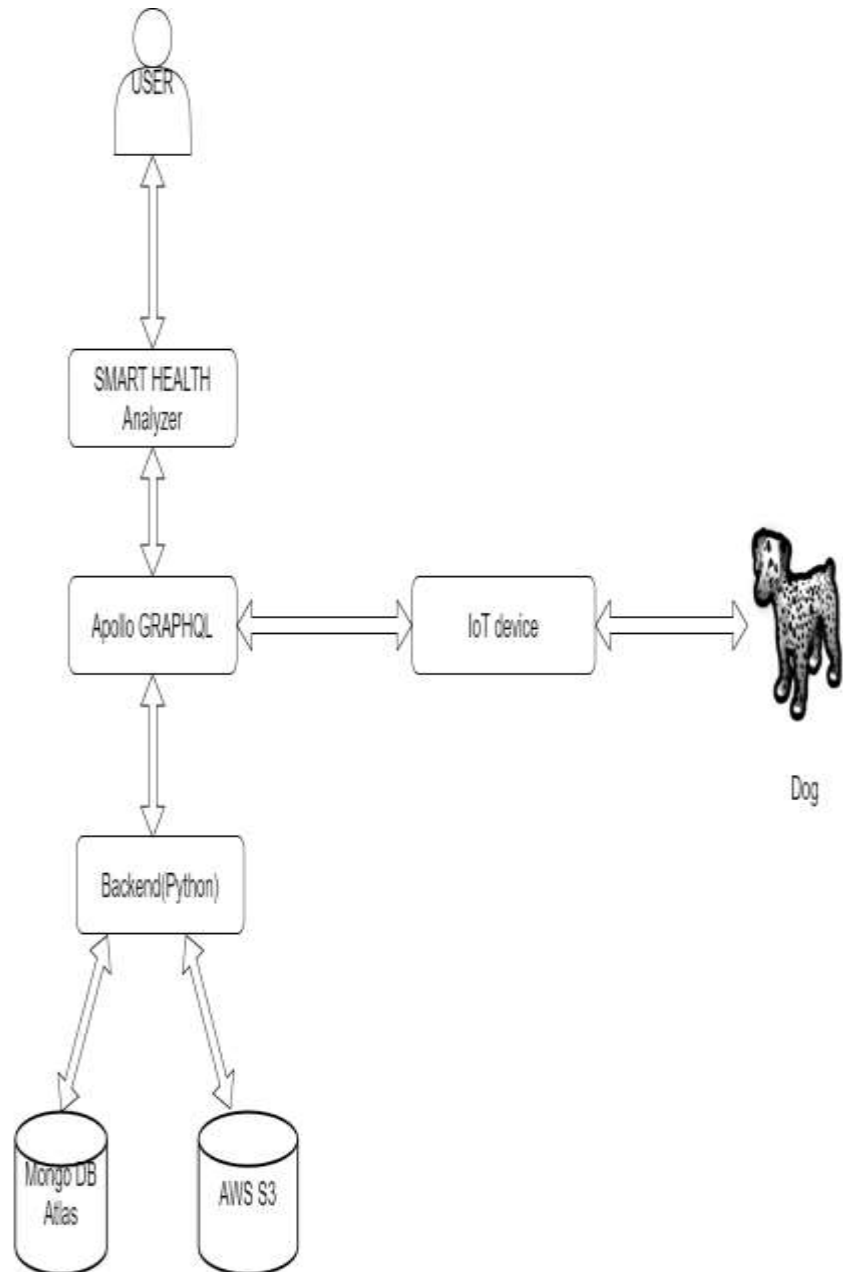
4.2 Sub Objective

To create an efficient and effective device that could analyze and translate dog acoustic barking patterns to human understandable language with the help of modern technology such as smartphones and IoT devices with a machine learning approach. The device should be able to give the dog owner a better understanding of the pet dogs behavioral mental states such as sad, pain, happy, needs special attention etc. This should help the dog owner to understand the dog better so the owner could attend to the dog's wants and needs properly. The translator should make the dog and the owner more intimate.

4.3 Specific Objectives

- To understand whether the dog is in stress.
- To treat the dog in a better manner
- To attend to the dog's wants and needs in a proper manner.

5. Methodology



Text

Figure 5:1: System diagram

5.1 IoT device

The IoT device is attached to the dog neck. It has a active noise cancellation microphone which captures only dog barking sounds filtering unnecessary background and third party sounds. This will help the model to correctly identify the dog barking sound exactly . In the IoT device there is a NORD MCU connected. The Node MCU technology which has **WIFI and Bluetooth** capabilities. This technology will be used to communicate and transfer data to the “Smart Translator” mobile app component. The IoT device is light weight accessory which will be extremely comfortable when attached to the dog. It will com with a comfortable plastic casing covering the electronic parts of the device. The device will be attached to the dog according to the no pull configuration. The strap that binds the device to the dog will made with extremely comfortable material.

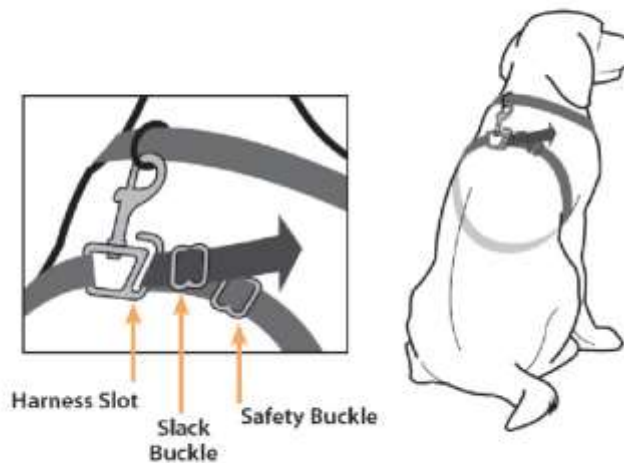


Figure 5.2: No pull configuration

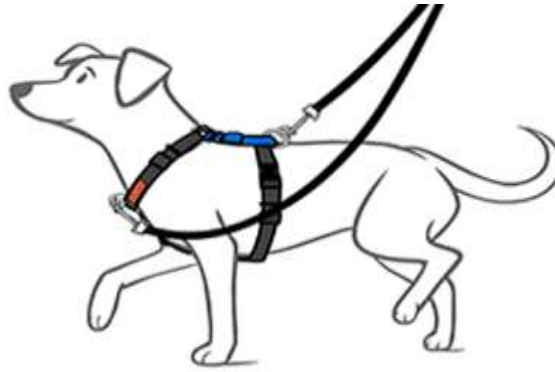


Figure 5.3: No pull configuration attached to the dog

5.2 System overview

The IOT device with an active noise cancellation microphone which is attached to the test subject will be recording soundtrack clips. These sound clips will be transmitted through the Arduino board using Wi-Fi or Bluetooth technology to the mobile phone's REST API.

Then the data will be captured from the API. Here the API is implemented using Apollo Graph QL. The API will be uploading the data to the server. In the server, the raw data will be converted using an FFT mathematical algorithm to constituent frequencies. FFT algorithms are used to preprocess data for noise cancellation filtering and data normalization. Processed data will be transmitted to the AWS S3 cloud service for data analysis.

To train the machine learning model barking clips will be recorded from many pet dogs in different environmental, mental, and physical conditions. For this project a data set will be used from a previous research projects previously done . Classification of dog barks: A machine learning approach research provides directs links to serval data sources that consists dog barking sound clip data sources[7]. Using this preprocessed and pre labeled data clip sources the machine learning model will be trained. Around 1000 clips will be used under different categories such as Play, Fight, Alone, Stranger, Walk, Sad and Ball. This kind of labeled data will train the model. Once the test model is done it will build it own model. Once the model is trained it will analyze incoming sound clips from the microphone and identify what the subject is trying to say. Gathered data will be analyzed by this model It will identify special

characteristics of the sound clip and compare it with the training data set. According to the comparison the model will output what the pet dog is exactly saying. The output will be one of Play, Fight, Alone, Stranger, Walk, Sad and Ball dog barking categories. According to this output the owner will be able to understand the state of the dog.

The processed data will be then re-transmitted to the API of the mobile app. The component will output the processed information to the owner.

5.3 Testing

The testing process will be done with the help of dog expertise in the field here in Sri Lanka. Members of KASL - Kennel Association of Sri Lanka and CKC - Ceylon Kennel Club who has a wide range of experience on dog behavior will be evaluating the device against the output results and they will be giving their feedback on the component output.

- With permission of the dog owners in the KASL and CKC the device will be attached to their dogs.
- All field testing implementations will be done under the direct supervision of the dog owner.
- Selected member will be allowed to test the device with proper guidelines

6. Project requirements

5.4 Functional requirements

1. The component should have correct and all required permissions such as storage and notifications properly.
2. Since the app will be using online services to process sound clips and output it will require a proper working mobile network connection or a Wi-Fi connection.
3. Since the IoT device will be using Wi-Fi chip to communicate with mobile component API the mobile phone should always have Wi-Fi switched on.
4. The dog owner should be able to get the barking output translation by just clicking one button "Translate."
5. As soon as the user enters the app component the translator should have two options to enter and exit the translator component.
6. There should be a another button as "Listen " which will start the listening process. When the listening process is started the mobile app component will be dog patterns through the IoT device and will be transmitting data directly to the API of the mobile app component.

5.5 Non-Functional requirements

1. Usability

The app should be able to achieve user's required goals efficiently and effectively.

2. Performance

When the user interacts with the system the system should be able to output the result efficiently as possible. The execution time should be minimum as possible.

3. Reliability

The app output accuracy should be error free, and the code should be bug free so the translation output could be reliable.

4. Readability

The output of the barking pattern should be easily understandable to the dog owner.

5. Availability

The dog owner should be able to access and translate the dog barking pattern at any given time.

7. Conclusions and Recommendations

The proposed solution which consists an IoT device and mobile component can provide a solution as a dog translator. This can translate dog's acoustic barking patterns to human understandable language , strengthening the human-dog bond further. Current devices which are available in the market has many constraints to them. This leads to many problems when it comes to proper dog translation All the characteristics provided by current products in the market can be compared to proposed solution as mentioned below.

Current products	Proposed solution
Many dog translators has not used any scientifically proven methods to justify the results.	Proposed system will be using existing research data to output with maximum accuracy
A unit cost around \$100 which is equal to around Rs 20000.00	Proposed solution can offer a unit for around Rs. 3000.00 which is a around \$10.00. (Proposed solution can offer a product which is cheaper around ~1/10 than current products in the market)
Since current products only uses the separate device to translate is takes considerable amount of time to process a dog bark.	With help of modern technology such as cloud services, smart phones which has plenty of processing power and powerful services proposed system can output extremely fast
Old low grade microphone can not identify sounds if properly if the wind sound is high .	Proposed solution uses active noise cancellation microphones to filter sounds correctly .

8.Budget and budget justifications

Device	Cost
Node mcu	850.00
Resistors	100.00
Leash	500.00
box	150.00
DB subscriptions	2850.00
Microphone	450.00
Total	4900.00

Table 8.1 : Budget and justifications

- Above budget is an approximate value calculation on the IoT device.
- Since this calculation is only done for one device when it comes to mass commercial production the cost can be reduced. Costs like DB subscriptions will be divided among many users. Also bulk purchases will reduce the cost greatly . This we enable to release this for around Rs.3000.00
- The app will be completely free so the dog owner only has to purchase the device for the dog. There fore the complete unit will be reasonable for all customers.

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Appendices

Appendix A: Complete questionnaire results

