METU, Department Of Computer Engineering

Graduation Project

Proposal Form

Project Information

Title

I-Cowboy (Indoor Crowd Behavior Analysis via Thermal Imaging Sensors)

Target

Public [ ] Restricted [YES]

Proposer Information

Faculty Member	

Student Members of the Team	Ebru İpek Aktukmak - 1941715 Ekrem Demirhan – 1941921 İlker Tuna Tuzcu– 1942424 Buğrahan Yalçınkaya – 1942481
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IP (Intellectual Property) Information

LNL Technology will own all the rights of the project when project is completed.

Project Description and Background Information

Description

Indoor Crowd Behavior Analysis via Thermal Imaging Sensors (I-Cowboy)

Nowadays buildings have become very large and crowded, with a lot of utilities for security, comfort and business purposes. Buildings such as corporate offices, malls or cultural centers have a great deal of energy consumption mainly due to lighting and HVAC. The cost associated with operation of such systems are so high that there are specifically people and software managing such buildings. One of the major problems in managing these costs is high mobility of the people in the building. Due to this mobility, it is not always possible to optimally control air conditioning or lighting. I-Cowboy aims to solve this type of problems by tracking the crowds and keeping their statistics. In addition to that, it opens new doors to use this mobility on business. With provided statistics, corporations and small businesses have an efficient way to make more profit. The uniqueness of this project is that it tracks people while protecting identities and privacy.

Development of the project will be designed by Ebru İpek Aktukmak, Ekrem Demirhan, İlker Tuna Tuzcu, and Buğrahan Yalçınkaya, and sponsored by LNL Technology.

Basically, I-Cowboy takes pictures of interested regions frequently as the first step. Because of the fact that our purpose is protecting privacy and identity, we are using thermal cameras. After processing these images, we determine peoples' locations in the actual area and these data will be stored. By analyzing the stored data, we are able to create statistical data and graphics according to the time so that we will obtain the data about human density at a certain time and place and make predictions about future outcomes.

On I-Cowboy, many branches of computer science will be used like IoT, image processing, deep learning, and artificial intelligence. Depending on size of specific area one or more thermal sensors will be placed. Footage from the thermal sensors will be stored in our MongoDB database via our server which will be written in NodeJS. Our system will process the image data continuously and by extracting results from this sector, it will determine the number of people at a certain area and time. Which means if there is an alert that shows that a person is moving to one sector, it will increase the number of people in that area, at the same time it will decrease the number of people in the area that person exits. At the end we will log the data which shows how many people are where and in which part of the area at a certain sector. We will log the data which shows how many people are where and in which part of the area at a certain time. We will draw a crowd graph from the logged data and then analyze this data by data mining and use deep learning techniques to estimate the expected amount of people at a location for a given future time.

The development of the project will last 9 months. By the end of the first half, we plan to get the aforementioned functionalities working and present it on our website. In the second half of the development, we will apply the system for real scenarios and determine application areas. If the necessary permissions are given, we will set up the system in METU Department of Computer Engineering Building, Cafeteria, KKM or Çarşı. Then we will share our predictions. And using real results, we will determine the kinds of applications that we can develop for applying the most suitable scenarios.

Similar Products/Projects

VCount Company is working on the similar problem by using different techniques. They are using some products that counts the people entering and exiting to/from a place and according to this information they are informing the shop owners for some improvement.

Justification of the proposal

It will detect and record locations of the people in the certain area. After getting this information it will use logged data to predict possible future outcomes. While it is handling with this, it will also preserve and protect privacy and identity.

There is a need for detecting certain location of the people in certain area for decreasing the crowdedness and utilizing this crowdedness for commercial advertisement by preserving privacy and identity. Also, thermal cameras have higher cost.

In short , the main points of the project will be focused on energy consumption, identity and privacy protection.

Contributions, Innovation and Originality Aspects of the Project

We will use thermal sensors to get information instead of using cameras or thermal cameras. We will determine exact location of people in certain area. Also, we are planning to draw a path for each person in this area.

We are planning to detect the number of people and their paths using thermal sensor data by protecting their identities instead of counting the people who are entering and exiting the place and also we will do this using thermal sensors.

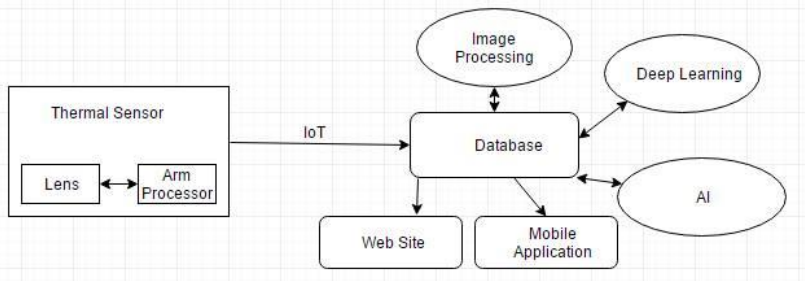
Privacy is a primary concern nowadays, so both at national and international level, some of the products which exist already can be used at the courts as an evidence that shows that some people are breaking the privacy and identity laws against human being. So this system will watch people by not tagging them. Therefore, it will prevent people from using this system as an evidence at the courts. Which means it will be completely safe against identity and privacy breach. In addition to this, this project will have a lower cost than other systems.

For the future, this system can be used for coma patients to detect any physical movement rather than human reflexes. Also, this project can detect human behavior in many different public areas if it is advanced further.

Technical Aspects of the Project

Technically, we will place the thermal sensors at the required points in a certain place. We will get the sensor data from them and we will process this data by using image processing techniques. After processing images, we will create some statistical data and graphics by associating according to the time so that we will obtain the data about human density at a certain time and place. After some point, system will try to predict this information itself by using artificial intelligence and data mining techniques.

We are planning to follow this block diagram.



Targeted Output, Targeted User/Domain Profile

Actually this system can be optimized for many areas of use. For now, we are targeting to watch the people at the shopping malls since there may be lots of result diagrams, predictions, and suggestions for the owners of these shopping centers. Which means at the first place, the system will watch the people, their movements and their paths in the shopping malls, and it will inform the owners of shops by suggesting some information about their business. But as we implied at the description part of the project, after observing the results of system, we may apply this system for hospitals etc. systems by also using the behavioral models of the data. When we finish the project, what we expect to get is a kit product including the sensors and the web and mobile application for the end users at the end. And the shop and shopping center owners will utilize the product.

Project Development Environment

Java or Python, C ,C++
Thermal sensor, Raspberry Pi or Arm processor (Most Likely),
MongoDB, NodeJs, OpenCV,
TortoiseSVN, Icescrum,

External Support

Thermal sensor,
Raspberry Pi or Arm processor (Most Likely)

LNL Technology will provide thermal sensors and Arm processors.
If allowed, we are planning to use TortoiseSVN and Icescrum via LNL Technology's server.

We are planning to consult Faysal Başçı from LNL Technology company.

References

Similar Products
http://tr.v-count.com/

Company
http://www.lnl.com.tr/tr/home