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HOW-R-U?

Suite of e-coaches aimed to analyse human behaviour

Carlos Sánchez Páez Oresti Baños Legrán

17th July 2020

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• E-coaches suite as chatbots.

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- Doctors have high workloads.

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- Mental disorders are very common in our society.
- Doctors have high workloads.
- Mental diseases are taboo.

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- Mental disorders are very common in our society.
- Doctors have high workloads.
- Mental diseases are taboo.
- No continuous traceability of patient's health status.

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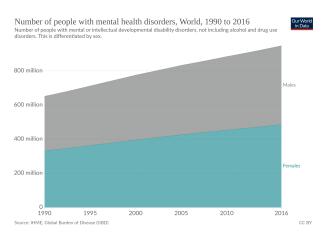


Figure: Number of people with mental health disorders

Reprinted from (Ritchie & Roser, 2018).

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- Technology is becoming increasingly integrated into our lives.
- Smartphones are used in a daily basis.

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- Technology is becoming increasingly integrated into our lives.
- Smartphones are used in a daily basis.
- Chatbots are becoming growingly becoming popular.

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- Technology is becoming increasingly integrated into our lives.
- Smartphones are used in a daily basis.
- Chatbots are becoming growingly becoming popular.
- In Spain there are 2 psychologist per 100.000 citizens (Vicente, 2019).

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• Main goal:

• Conversational-agent-as-a-sensor that asks questions to patients.

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- Conversational-agent-as-a-sensor that asks questions to patients.
- Questions will be defined by specialists.

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- Conversational-agent-as-a-sensor that asks questions to patients.
- Questions will be defined by specialists.
- Secondary goals.

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- Conversational-agent-as-a-sensor that asks questions to patients.
- Questions will be defined by specialists.
- Secondary goals.
 - Graphical web interface for doctors.

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• Main goal:

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- Questions will be defined by specialists.

- Graphical web interface for doctors.
- Flexible and scalable architecture to add functionality to the system.

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Main goal:

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- Architecture based on containers to host the different system modules.
- Implement a system that covers the previous goals.

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• Main goal:

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- Questions will be defined by specialists.

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- Architecture based on containers to host the different system modules.
- Implement a system that covers the previous goals.
- Test a beta version of the system to retrieve target audience's feelings about it.

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Number of publications related to chatbots

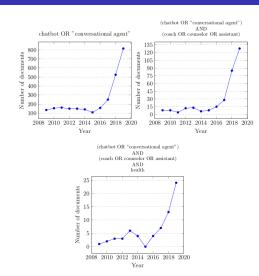


Figure: Search results of different queries performed in scopus.com.

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Conversational agent types

• Coaches: help users to get what they want.

Conversational agent types

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- Coaches: help users to get what they want.
- Counselors: help users to identify and solve problems.

Communication formats

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Platform	Daily active users (billions)	Free API for chatbots
(Facebook Messenger, 2008)	1.66	✓
(Whatsapp, 2009)	1.5	X
(WeChat, 2011)	1.083	✓
(Telegram, 2013)	0.2	✓
(Kik, 2010)	0.015	✓
(Discord, 2015)	0.014	✓
(<i>Slack</i> , 2013)	0.012	✓
(Viber, 2010)	0.008	✓
(Line, 2012)	0.00723	✓

Table: Comparison between different chat applications (2019).

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 Facebook likes can be helpful to predict people's sensitive properties (Kosinski, Stillwell, & Graepel, 2013).

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- Facebook likes can be helpful to predict people's sensitive properties (Kosinski et al., 2013).
- Whatsapp's end-to-end encryption methods are not secure enough (Rastogi & Hendler, 2017).

- Original Control and motivation Collection Collection and motivation Collections and motivation Collections and other art and the art and
- Facebook likes can be helpful to predict people's sensitive properties (Kosinski et al., 2013).
- Whatsapp's end-to-end encryption methods are not secure enough (Rastogi & Hendler, 2017).
- Telegram provides more privacy protection (Sutikno et al., 2016).

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- Must have requirements.
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 - Questions and answers should be modifiable.

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- Could have requirements.
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 - Timezones support.

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Architecture

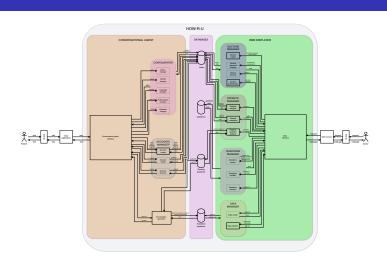


Figure: System architecture. Created using *diagrams.net* (*diagrams.net*, 2020).

Architecture

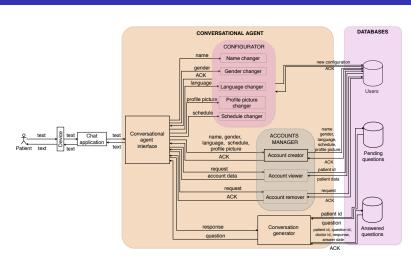


Figure: System architecture (conversational agent and databases).

Architecture

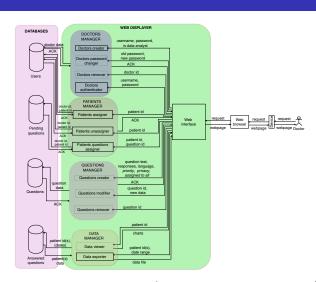


Figure: System architecture (web interface and databases).

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Implementation (databases)

```
ForeignKey (id)
                                                                       ForeignKey (id)
patient
                 ForeignKey (identifier)
                                                       pet/ent
                                                                       ForeignKey (identifier)
                  ForeignKey (id)
                                                       question
                                                                       ForeignKey (id)
                  ForeignKey (id)
answer_date
                 DateTimeField
                                                                            abstract
                      sponse (answeredouestion)
                                                                          nheritance
                                                                      ForeignKey (id)
                    ForeignKey (id)
                                                                     ForeignKey (identifier)
     order
                    IntegerField
                                                                     ForeignKey (id)
                    CharField
                    question (response)
                Question
                                                                    Patient
                       ForeignKey (id)
                                                                       Charfield
  assigned to all
                                                                                                      doctor (journalentry)
  frequency
                       Charfield
                                                         schedule
                                                                        DateTimeField
  language
                                                                       Charfield
                                                        language
                       IntegerField
                                                                       Charfield
  public
                       BooleanField
                                                        username
                                                                       Charfield
                       Charfield
                                                                 assigned_doctors (patient)
                                                          OneToOneField (id)
                                                         BroleanField
```

user (doctor)

```
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 - Start handler

- Handlers.
 - Start handler
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 - Start handler
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 - Start handler
 - Config handler.
 - Question handler.
- Jobs.

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 - Start handler
 - Config handler.
 - Question handler.
- Jobs.
 - PendingQuestionJob

Implementation (conversational agent start handler)

```
GENDER, PICTURE, LANGUAGE, SCHEDULE = range(4)
@send_typing_action
def start(update, context):
    Shows welcome message and asks for language
    # Check that user is not registered
    try:
        patient = Patient.objects.get(identifier=update.message.from user.id)
        logger.info( f'User {update.message.from_user.username} tried to register
       → again.')
        update.message.reply_text(text=messages[patient.language]['already_exists'])
        return ConversationHandler END
    except Patient.DoesNotExist:
        # The user should not exist in DB
        context.user data['patient'] = Patient(name=update.message.from user.first name.

    identifier=str(update.message.from_user.id),

    username=update.message.from_user.username)

        logger.info(f'User {update.message.from user.username} started a new

→ conversation!)
        send_welcome_message(patient)
        send_language_selection(patient)
    return LANGUAGE
```

Implementation (conversational agent start handler)

```
Publication valued to charter when the charter published published
```

Implementation (conversational agent PendingQuestionJob)

```
class PendingQuestionJob(object):
 def init (self, context, patient):
     self.patient = patient
     self._create_job(context)
 def create job(self, context):
     context.job_queue.run_daily(callback=self.job_callback, time=self.patient.schedule,
     → name=f'{self.patient.identifier}_pending_questions_job')
 def job callback(self, context):
     pending_questions = self._get_pending_questions()
     for task in pending questions:
         if not self.is_question_answered(task):
           task.answering = True
            ask_question(task, self.patient)
     send_message(self.patient, "All questions have been answered")
     if was_configurator_running(self.patient.identifier, context):
       reopen_configurator(self.patient)
```

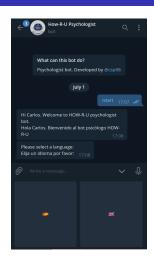


Figure: Agent showing the welcome message and asking for language selection.

```
Please specify the time when you would like to receive questions in
HH:MM format (24h)
You have been successfully registered into the system. 18:55
How do you feel today? 10:00
                                                                             0-2 hours
                                                                             2-4 hours
                                                                             4-6 hours
```

Figure: HOW-R-U converstional agent asking a question to a patient.

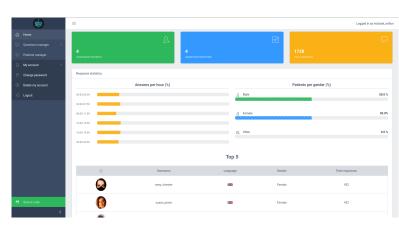


Figure: HOW-R-U homepage.

```
@login required(login url="/login/")
 def index(request):
     Shows the index page, including global parameters (top patients, number of
associated patients, answers, gender and time percentages, etc.,)
     doctor = request.user.doctor
     top_patients = get_top_patients(doctor)
     doctor_patients = doctor.patient_set
     number_associated_patients = doctor_patients.count()
     submitted_questions = Question.objects.filter(creator=doctor).count()
     total_answers = get_total_answers(doctor)
     male percentage, female percentage, other percentage = get gender stats(doctor,

→ number associated patients)

     answers_per_hour = get_answers_per_hour(doctor)
     context = {
         "top patients": top patients.
         "number_associated_patients": number_associated_patients,
         "submitted_questions": submitted_questions,
         "total answers": total answers.
         "male_percentage": male_percentage,
         "female_percentage": female_percentage,
         "other percentage": other percentage.
         "answers per hour": answers per hour
     return render(request, "index.html", context)
```

reposal context and motivation objections are of the set of the se

	Question text (empty to get all questions)						
Question text	Possible responses	Assigned to all	Frequency	Priority	Creator	Language	Actions
Do you feel sad and cry easily?	Yes No	v	Daily	1	michael_milton (You)		
Have you felt insecure about yourself today?	Yes No	×	Daily	1	john_clive	88	Add to My Question
How do you feel today?	Sad Tired Happy Very happy	v	Daily	1	michael_milton (You)	88	
How long have you slept today?	0-2 hours 2-4 hours 4-6 hours 6-8 hours More than 8 hours	~	Daily	1	michael_milton (You)	88	

Figure: Public questions page.

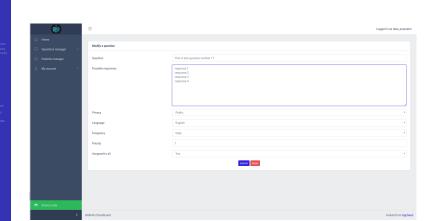


Figure: Questions creator and modifier.

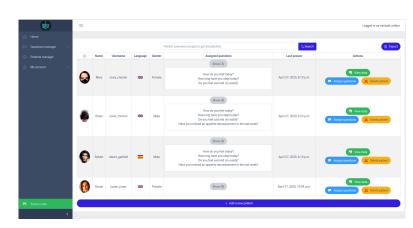


Figure: Patients manager.

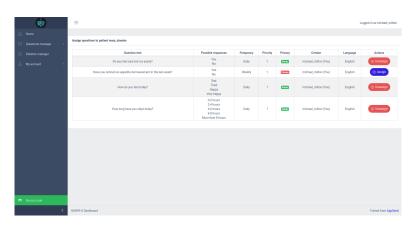


Figure: Patients manager assign questions page.

```
Select patients to export
                                               susan iones
                                              robert_garfield
                                              oliver_morton
                                              mary_chester
                                              04/01/2020
                                                                                                                                                                        Start date
                                            Please enter a valid date
                                              mm/dd/yyyy
End date
                                              June 2020 *
                                                                   \uparrow \downarrow
                                                                                Submit Reset
                                                   8 9 10 11 12 13
```

5 6 7 8 9 10 11 Today

Figure: Export page

Patient username Question		Answer	Date	
robert_garfield	How do you feel today?	Tired	2020-04-01 04:12:20	
robert_garfield	How do you feel today?	Sad	2020-04-02 05:24:20	
robert_garfield	How long have you slept today?	0-2 hours	2020-04-01 12:56:20	
robert_garfield	How long have you slept today?	4-6 hours	2020-04-02 11:28:20	
robert_garfield	Do you feel sad and cry easily?	Yes	2020-04-01 14:22:21	
robert_garfield	Do you feel sad and cry easily?	No	2020-04-02 06:31:21	
oliver_morton	How do you feel today?	Very happy	2020-04-01 01:45:19	
oliver_morton	How do you feel today?	Нарру	2020-04-02 02:59:19	
oliver_morton	How long have you slept today?	More than 8 hours	2020-04-01 20:51:20	
oliver_morton	How long have you slept today?	2-4 hours	2020-04-01 22:24:20	
oliver_morton	Do you feel sad and cry easily?	No	2020-04-01 07:47:20	
oliver_morton	Do you feel sad and cry easily?	Yes	2020-04-02 17:26:20	
oliver_morton	Have you noticed an appetite decreasement in the last week?	Yes	2020-04-01 21:41:20	
oliver_morton	Have you noticed an appetite decreasement in the last week?	Yes	2020-04-08 21:09:20	

Table: Example data generated with the *Export* feature.

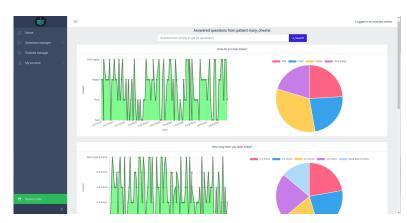


Figure: View data page.

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Development environment

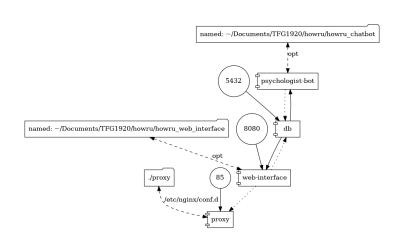


Figure: Docker-compose file schema. Generated by (PSIH, 2016).

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Production scalable environment

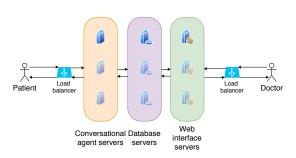


Figure: Scalable environment architecture diagram. Created using diagrams.net (diagrams.net, 2020).

Production non-scalable environment

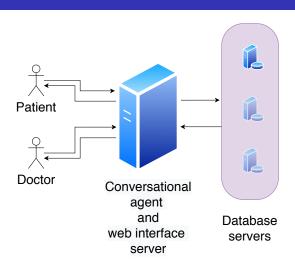


Figure: Non-scalable environment architecture diagram. Created using *diagrams.net* (*diagrams.net*, 2020).

Production one-instance environment

```
Patient

Doctor

HOW-R-U server
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Figure: One-instance environment architecture diagram. Created using *diagrams.net* (*diagrams.net*, 2020).

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STRENGTHS

- 1. Different scenarios.
- 2. Multiple e-coaches.
- 3. Intuitive interface.
- 4. No extra software for patients.

DPPORTUNITIES |

- 1. COVID-19 data analysis.
- 2. Telegram ensures privacy.

WEAKNESSES

- 1. Telegram is not used by the majority of people.
- 2. System deployment requires knowledge on computer science.

THREATS

- 1. Elder people may not know how to use Telegram.
- If patients do not have Telegram installed, they could install a specific app instead of Telegram.
- 3. Not all patients have smartphones.

Figure: HOW-R-U SWOT analysis. Based on http://www.mostlycolor.ch/2015/07/swot-matrices-in-latex.html.

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• Main goal: Conversational-agent-as-a-sensor that asks questions defined by specialists to patients.

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- Main goal: Conversational-agent-as-a-sensor that asks questions defined by specialists to patients. ✓
- Secondary goals.

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- Secondary goals.
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Time for questions